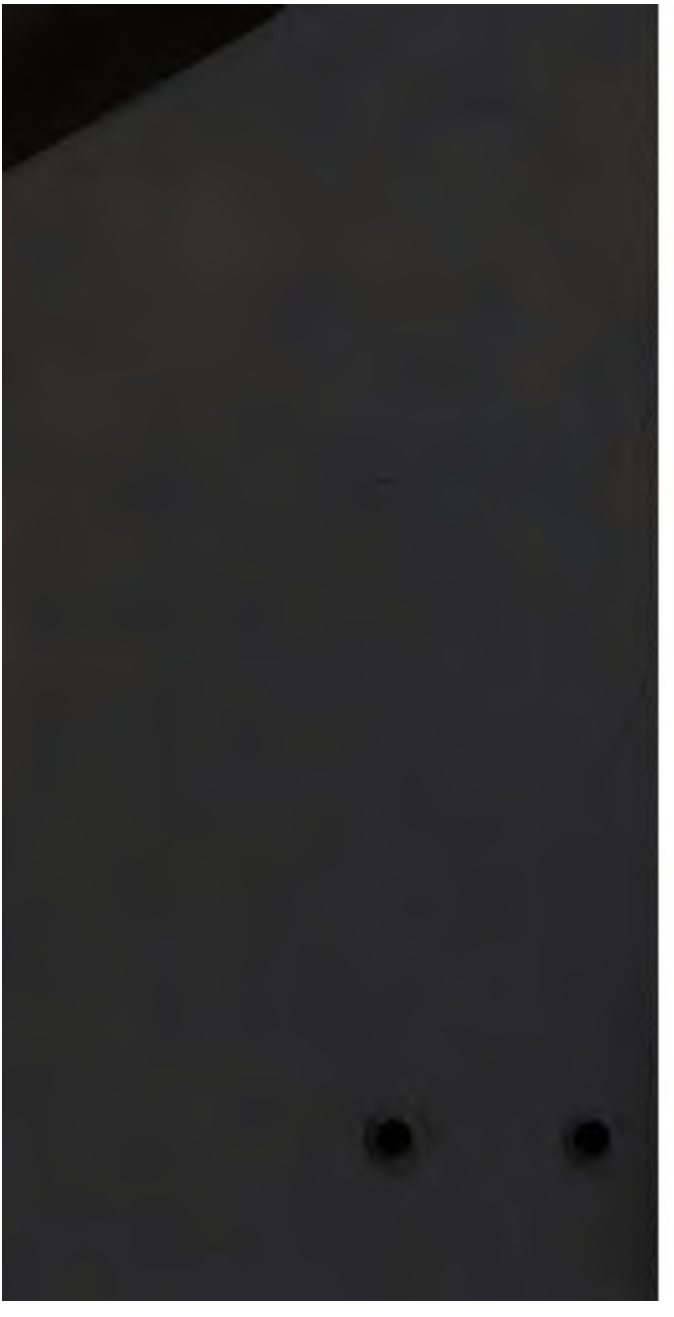

A

CONCISE INTRODUCTION

TO

PRACTICAL ARITHMETIC:

IN WHICH ALL THE

RULES THAT OCCUR IN COMMON BUSINESS

ARE APPLIED TO THE

FEDERAL CURRENCY.

Designed for the Use of Schools in the United States.

BY SAMUEL TEMPLE, A. M.

Seventh Edition.

BOSTON:

PRINTED AND PUBLISHED BY LINCOLN & EDMANDS.
Sold at their Theological & Miscellaneous Bookstore, 53 Cornhill,
and by the principal Booksellers.

1813.

PREFACE
TO THE SIXTH EDITION.

The demand for this Introduction *to* Arithmetic *has assured the Author, that it meets public approbation.*

To Schoolmasters, and others, who have encouraged the sale of this little performance, the Author presents his most grateful acknowledgments.

Since the publication of the second edition, *of this Work, a few trifling* errors *have made their appearance. However immaterial these errors may have been, the public may rest assured that* this edition *is correct.*

As the mode of reckoning the old denominations *of money, viz.* pounds, shillings, *&c. is almost universally rejected, the number of examples, for calculating in that currency, is abbreviated.*

In order to render this edition more valuable than any of the preceding, without enhancing the price of the book, Duodecimal Arithmetic, *as applied to the mensuration of* Superficies *and* Solids *is annexed to the end of the work.*

To serve his country, by endeavouring to diffuse the means of useful knowledge among the American youth, *is the incessant study of*

THE AUTHOR.

Dorchester, (Mass.) July, 1808.

SEVENTH EDITION.

The rapid sale of six large editions of Temple's Arithmetic, sufficiently decides the utility and merits of the work, and renders other recommendations unnecessary. The publishers, besides printing this Seventh edition on a better paper, have spared no pains to preserve it free from errors, and still worthy the liberal patronage of the public.

Boston, June 1, 1813.

Contents.

A

CONCISE INTRODUCTION

TO

PRACTICAL ARITHMETIC.

ARITHMETIC, *in theory*, is the science of numbers; *in practice*, it is the art of computing or calculating by numbers, in such a manner, as shall most readily serve the various purposes of life.

Arithmetic is comprehended in five principal rules, viz. Numeration, Addition, Subtraction, Multiplication, and Division. By the right application of these rules are solved all questions, in which arithmetic is concerned.

Numeration teacheth to express the value of any number, or quantity, by the ten following characters: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.——0 is called a cypher or nought; 1 one; 2 two; 3 three; 4 four; 5 five; 6 six; 7 seven; 8 eight; 9 nine. By the various combination of the foregoing characters, which are called figures, or digits, all numbers are expressed; and, in any combination of figures, the value of each is determined by the place it occupies, as is shown in the following table.

NUMERATION TABLE.

Billions	Hund. of thous. of mill.	Tens of thous. of mill.	Thousands of millions.	Hundreds of millions.	Tens of millions.	Millions.	Hundreds of thousands.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Units.
												1
											2	2
										3	2	1
									4,	5	3	5
								2.	5,	2	1	6
							5	3	4,	5	6	7
						6,	8	4	3,	2	8	4
					7	8,	5	0	2,	1	2	0
				8	4	6,	3	5	2,	9	0	8
8,	5	6	9,	4	9	3,	7	4	1,	3	4	5

Explanation of the foregoing Table.

To enumerate any number of figures, begin at the right hand and proceed to the left.

The first right hand figure of any number is called units; the second, tens; the third, hundreds; the fourth, thousands, &c. Each figure, from right to left, increases in a ten fold proportion: that is, the second figure from the right hand is ten times the value of the same figure in the place of units. The third is ten times the value of the second; the fourth, that of the third; and so of the rest.

EXAMPLE. In the third line of the Numeration Table (counting from the top) I find 3, in the place of hundreds, which is *three hundred*; 2, in the place of tens, which is *twenty*; and 1, in the place of units, which is *one*; therefore, the whole value of that line is *three hundred and twenty-one.*

APPLICATION.

Write, in figures, the following numbers.

1st. Six hundred and twenty-five.
2d. Three thousand, one hundred and ten.
3d. Forty-five thousand, two hundred and sixteen.
4th. Thirty-three thousand, two hundred and two.
5th. One hundred and twelve thousand, five hundred.
6th. One hundred thousand and twenty-nine.
7th. Two million, three hundred and twenty-thousand, five hundred and eleven.
8th. Sixty-nine million, eight hundred and two thousand, three hundred and five.
9th. Seventy-two million, thirteen thousand and nineteen.

Write in words each line of the Numeration Table, respectively, beginning at the top.

ADDITION.

ADDITION is the collecting of *two* or *more* numbers into *one* sum; and is both simple and compound.

Simple Addition teacheth to collect, into *one* sum, several numbers, which consist of one denomination only.

Compound Addition teacheth to find the amount of two or more numbers, which consist of several denominations.

SIMPLE ADDITION.

RULE 1st. Place units under units; tens under tens; hundreds under hundreds, &c.

RULE 2d. Begin with the right hand column, or line of *units, when two* or more numbers are to be added together.

RULE 3d. Carry *one* for every *ten*;* that is, in adding the first column of any sum, if it exceed *ten*, *twenty*, *thirty*, *forty*, &c. set down what there are *over ten* or *tens*, and carry as many to the second column, as there were tens in the first;—thus proceed with each column, till the last is added, under which set down the whole amount.

PROOF. Add each column as before, omitting the top line; set this amount under the first; then, if the amount of this and the top line be equal to the total sum, the work is right.

EXAMPLES.

	1	2	3	4
	3 7 6	7 8 6 5	5 6 2	8 7 5 6
	4 9 3	3 5 8 6	1 7 3	2 1 0 8
	1 0 2	4 3 2 1	4 5 2	4 6 7 9
	3 1 5	8 5 7 6	0 2 1	6 5 2 3
	1 2 8 6			
	9 1 0			
Proof.	1 2 8 6			

In the first example, I say, five and two are seven and three are ten and six are sixteen; I then set down what there are over ten, which are six, then proceed with the second column thus,—one that I carry to one are two, and nine are eleven, and seven are eighteen; I set down eight, and carry one to three, which are four, and one are five, and four are nine, and three are twelve; I then set down the whole.—In the next place, I add each column as before, omitting the top line, and set the amount under that of the whole sum; lastly, I add the sum of all, except the top line, *to* the top line, and find the amount is equal to the whole sum; therefore, I conclude the work is write.

	5	6	7
	pounds.	dollars.	miles.
	5 7 6 8 4	9 8 7 6 5 4	5 4 3 2 1 7 6
	9 7 6 8 0	3 2 1 0 9 8	3 8 7 9 5 4 7
	3 5 4 7 2	7 6 5 4 3 2	3 9 5 4 6 8 7
	4 8 7 6 5	1 0 9 8 7 6	2 1 3 8 7 8 6

* The reason of this is, because the value of each figure from right to left increases in a ten fold proportion; that is, ten units, or ones, make *ten*; ten *tens*, an *hundred*; and ten *hundred*, one *thousand*, &c.

8									
8	7	6	9	5	4	3	8	6	5
4	3	8	5	7	9	3	0	8	6
4	7	9	3	7	2	0	8	2	1
1	8	7	3	4	5	9	7	6	3

9									
8	9	0	3	5	6	8	5	4	9
1	2	3	4	5	6	7	8	9	0
9	8	7	6	5	4	3	2	1	0
8	7	6	5	4	8	2	1	2	3

Practical Questions.

1. A man has four farms. The first is worth two thousand, seven hundred, and twenty-five dollars :—the second is worth three thousand, eight hundred and nineteen dollars ;—the third is worth one thousand, six hundred and ten dollars : the fourth is worth five hundred and twelve dollars ; what are they all worth ? 8,666 dols. Answer.

2. A man has four horses. The first is worth eighty-four dollars ; the second is worth forty-five dollars ;—the third is worth as much as the second ; and the fourth is worth as much as the first ; what are they all worth ? 258 dols. Ans.

3. A man possesses a tract of land, which contains forty-nine thousand, eight hundred and thirty five acres ; now, suppose he had *six* tracts of equal dimensions, how many acres would the whole contain ? 299, 010 acres. Answer.

4. Suppose one ox weigh one thousand and forty-five pounds ; another, eight hundred and twelve pounds : and a third, nine hundred and one pounds ; what is their whole weight ? 2,758 pounds. Ans.

5. The hind quarters of a cow weigh one hundred and three pounds each ; the fore quarters weigh ninety-seven each ; the hide, sixty-three, and the tallow, fifty-six ; what is the weight of the cow ? 519 pounds. Ans.

Compound Addition.

Compound Addition teacheth to find the total sum of two or more numbers, which consist of several denominations.

Rule 1*st*. Each denomination must be placed directly under that which is of the same name ; that is, farthings must be placed under farthings, pence under pence, shillings under shillings, &c.

Rule 2*d*. Carry for *so many*, in every denomination, as make *one*,* in the next higher denomination.

Proof. In order to prove any sum in Compound Addition, proceed in the same manner as in Simple Addition.

* This may be illustrated by the following observation. As there are four farthings in one *penny, it is evident that* there are as many pence in any number of farthings as there are times *four in that number.*

Before the learner begins to work questions in lawful money, it would be well to commit to memory the following Tables.

Pence Tables.

pence.	s.	d.		s.	d.
20 are	1	8		2 are	24
30 ——	2	6		3 ——	36
40 ——	3	4		4 ——	48
50 ——	4	2		5 ——	60
60 ——	5	0		6 ——	72
70 ——	5	10		7 ——	84
80 ——	6	8		8 ——	96
90 ——	7	6		9 ——	108
100 ——	8	4		10 ——	120
110 ——	9	2		11 ——	132
120 ——	10	0		12 ——	144
130 ——	10	10		13 ——	156
140 ——	11	8		14 ——	168
150 ——	12	6		15 ——	180
160 ——	13	4		16 ——	192

Lawful Money.

4 farthings make 1 penny, marked d.
12 pence —— 1 shilling, —— s.
20 shillings —— 1 pound, —— £.

EXAMPLES.

1

£	s.	d.	q.
45	8	6	1
38	7	3	2
15	3	4	3
10	4	8	0
109	3	10	2
63	15	4	1
Proof. 109	3	10	2

2

£	s.	d.	q.
898	13	4	3
725	10	9	1
636	14	3	0
543	07	5	3

Note. The most general method of expressing farthings, is thus:
$\frac{1}{4}$ one farthing; or, one fourth of a penny.
$\frac{1}{2}$ two farthings; or, half a penny.
$\frac{3}{4}$ three farthings; or, three fourths of a penny.

3

£.	s.	d.
856	3	$4\frac{1}{2}$
530	9	$8\frac{3}{4}$
711	11	$3\frac{1}{2}$
317	8	$6\frac{3}{4}$
2415	12	$9\frac{3}{4}$
1559	9	$5\frac{1}{4}$
2415	12	$9\frac{3}{4}$

4

£.	s.	d.
300	17	$9\frac{3}{4}$
173	14	$8\frac{1}{2}$
446	11	$7\frac{1}{4}$
950	13	$4\frac{3}{4}$

5

£	s.	d.
87	16	$7\frac{1}{2}$
19	13	$4\frac{1}{4}$
75	11	$10\frac{1}{2}$
16	1	$9\frac{3}{4}$

£.	6 s.	d.	£.	7 s.	d.	£.	8 s.	d.
8315	19	$3\frac{3}{4}$	418	11	10	87	19	$11\frac{1}{4}$
701	17	$6\frac{1}{2}$	510	14	$9\frac{1}{2}$	55	11	8
513	12	$8\frac{1}{2}$	16	4	$11\frac{3}{4}$	90	4	$7\frac{3}{4}$
7310	13	$4\frac{1}{4}$	3	17	$3\frac{1}{4}$	18	1	$2\frac{3}{4}$
17	10	$5\frac{3}{4}$	2	3	2	9	5	$6\frac{1}{2}$

Questions in Lawful Money.

1. A man has four horses. The first is worth eighty-four pounds, fifteen shillings and six-pence; the second is worth forty-eight pounds, thirteen shillings and four pence; the third is worth thirty-one pounds, six shillings and eight pence; the fourth is worth thirteen pounds, eight shillings and three pence; what are they all worth? £.178 3 9 Ans

2. A gentleman possesses land to the value of two thousand, five hundred and ninety-eight pounds, sixteen and ten pence; he has a ship worth two thousand, three hundred and nine pounds, six and eight pence; his notes are valued at eight hundred and twelve pounds, eight and nine pence, half penny;—he has cash to the amount of four hundred and eight pounds, twelve and a penny, three farthings;—what is the man worth? £ 6129 4 $5\frac{1}{4}$ Ans.

3. Suppose I owe to one man, sixteen pounds, three and four pence, half-penny;—to another, twelve pounds, one and six pence; to another, seven pounds, eight and two pence, one farthing;—to another, sixteen shillings and eight pence: what is the amount of all my debts? £. 36 9 $8\frac{1}{4}$ Answer.

4. A gentleman dying, left three children, to whom he bequeathed the following legacies, viz. to the second, he gave five hundred and thirteen pounds, fifteen and six pence;—to the third, three hundred and twelve pounds, eighteen and ten pence;—and to the first he gave a sum equal to both the others; what is the sum of all their portions? £.1653 8 8 Ans.

Federal Money.

10 mills*	make	1 cent,	marked ct.
10 cents	——	1 dime,*	——— dim.
10 dimes	——	1 dollar,	——— dol.
10 dollars	——	1 eagle,	——— E.

** According to the original, mills, dimes, are written milles, dimes; yet the omission of s, in one, and of i in the other, is, in my opinion, justifiable.

EXAMPLES.

1					2				
E.	dol.	dim.	ct.	m.	E.	dol.	dim.	ct.	m.
36	8	5	7	3	350	7	6	8	7
15	9	8	6	4	935	5	7	3	2
86	5	4	3	2	543	2	1	0	6
54	8	9	8	5	480	9	6	3	8

Note 1. Since every denomination in the federal currency increases in a ten fold proportion, all questions relating to it are wrought in the same manner as those of whole numbers.

Note 2. Although there are *five* denominations in federal money, yet *three* only will be made use of in this work, viz. *dollars*, *cents*, and *mills*.

Note 3. In all cases, when the number of cents is less than ten, the ten's place must be supplied with a cypher.

3			4		5			6	
dol.	ct.	m.	dol.	ct.	dol.	ct.	m.	dol.	ct.
345,	25,	6	85,	05	55,	87,	3	384,	50
715,	50,	7	17,	16	28,	08,	0	576,	09
980,	75,	5	95,	83	17,	40,	5	399,	95
253,	60,	0	12,	33	38,	05,	0	800,	08

Mills are separated from cents, and cents from dollars, by a comma, which denotes that mills are tenth parts of a cent, and cents, hundredth parts of a dollar.

Questions in Federal Money.

1. One man is worth one thousand, eight hundred and thirty-six dollars, fifty cents, three mills. Another is worth four thousand, three hundred and twelve dollars, twenty-five cents, seven mills. Another is worth seven hundred and eighty dollars, twenty cents. Another is worth one hundred and eighty dollars, sixteen cents, five mills. What are they all worth? dol. 7109, 12, 5 Answer.

2. A man has four notes, specifying the following sums, viz. Eighty-nine dollars, five cents. Sixty-five dollars, seven cents. Twenty-five dollars, ten cents. Four dollars, six cents. What is the sum of all the notes? dol. 183, 28. Answer.

3. A merchant buys a bale of cloth for one hundred and nine dollars, seventy-five cents. A quantity of salt for two hundred and fifty dollars, eight cents. A quantity of sugar for ninety-five dollars thirty-three cents, three mills. A cargo of tar for two thousand, five hundred and eleven dollars, fifty cents. A quantity of flour for two hundred and nine dollars, *twenty-five* cents, five mills. What did the above goods *cost?* dol. 3175, 91, 8 Answer.

Troy Weight.*

24 grains	make	1 penny-weight,	marked	pwt.
20 penny-wts.	——	1 ounce,	——	oz.
12 ounces	——	1 pound,	——	lb.

EXAMPLES.

lb.	oz.	pwt.	gr.
385	8	9	16
137	4	11	8
496	3	10	12
856	6	7	9

lb.	oz.	pwt.	gr.
703	9	5	10
584	3	15	14
857	6	8	13
631	3	5	4

Avoirdupois Weight.†

16 drams	make	1 ounce,	marked	oz.
16 ounces	——	1 pound,	——	lb.
28 pounds	——	1 quarter of an hundred wt.	——	qr.
4 quarters	——	1 hundred weight,‡	——	cwt.
20 hundred	——	1 ton,	——	T.

T.	cwt.	qr.	lb.	oz.	dr.
34	13	1	18	7	5
89	7	3	10	9	11
70	15	0	14	7	4
68	3	1	9	5	7

T.	cwt.	qr.	lb.	oz.	dr.
84	11	2	16	8	10
47	9	2	12	8	6
56	10	1	20	5	9
98	5	0	3	6	2

Apothecaries' Weight.§

20 grains	make	1 scruple,	marked	℈
3 scruples	——	1 dram,	——	ʒ
8 drams	——	1 ounce,	——	℥
12 ounces	——	1 pound,	——	℔

℔	℥	ʒ	℈	gr.
346	5	3	0	11
187	8	3	2	12
754	4	5	1	8
211	3	2	1	5

℔	℥	ʒ	℈	gr.
834	6	2	1	12
735	7	2	1	10
534	5	6	2	10
297	3	0	0	15

* By this are weighed gold, silver, jewels, and all liquors.

† By this are weighed iron, lead, sugar, and all other articles of a gross nature.

‡ An hundred weight is 112 pounds.

§ The apothecaries' pound and ounce are the same with the pound and ounce Troy.

NOTE. This is the weight by which apothecaries mix their medicines; but they buy *and sell them by Avoirdupois weight.*

Cloth Measure.

4 nails	make 1	quarter of a yard,	marked qr.
4 quarters	—— 1	yard,	—— yd.
3 quarters	—— 1	Ell Flemish,	—— E. Fl.
5 quarters	—— 1	Ell English,	—— E. E.
6 quarters	—— 1	Ell French,	—— E. Fr.

yd.	qr.	na.
356	2	1
756	1	2
357	3	3
685	0	1
876	2	2
568	1	0
785	0	1

E.Fl.	qr.	na.
84	1	3
75	2	1
86	0	2
57	1	1
89	2	3
78	1	0
53	0	2

E.E.	qr.	na.
35	3	1
76	4	3
98	2	1
75	0	2
50	3	0
68	4	3
77	1	2

E.Fr.	qr.	na.
56	5	3
86	4	2
78	3	0
95	2	1
23	0	2
78	3	3
84	4	1

Long Measure.*

3 barley corns	make 1	inch,	marked in.
12 inches	—— 1	foot,	—— ft.
3 feet	—— 1	yard,	—— yd.
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet	—— 1	rod, pole or perch,	—— rod.
40 rods	—— 1	furlong,	—— fur.
8 furlongs	—— 1	mile,†	—— mile.

smile.	fur.	rod.	yd.	ft.	in.	bar.
68	5	30	$4\frac{1}{2}$	1	7	2
78	3	10	3	2	5	1
85	6	29	4	0	9	1
79	6	20	$1\frac{1}{2}$	1	4	1

mile.	fur.	rod.	yd.	ft.	in.	bar.
86	6	25	3	0	8	1
57	2	15	$2\frac{1}{2}$	1	4	2
86	4	35	4	2	7	0
78	5	5	$3\frac{1}{2}$	2	5	1

The Surveyor's Chain is thus divided.

$7\frac{92}{100}$	inches	make 1 link.
25	links	—— 1 pole, or rod.
100	links	—— 1 chain.
10	chains	—— 1 furlong.
8	furlongs	—— 1 mile.

* Long measure is applied to things where length is considered, without regard to breadth.

† 60 geometrical miles, or 69 and an half statute miles, make one degree of the earth's circle, and 360 degrees make a great circle of the earth.

NOTE. 4 inches make a hand, and 5 feet a geometrical pace.

Square Measure.*

144 square inches make 1 square foot.
9 —— feet —— 1 —— yard.
30¼ —— yards —— 1 —— rod.
160 —— rods —— 1 —— acre.

A.	rod.	yd.	ft.	in.
340	90	25	5	100
563	70	5¼	4	40
789	49	12¾	4	19
657	23	8	2	4

A	rod.	yd.	ft.	in.
865	30	18	3	72
873	90	10	6	25
940	50	14	7	15
386	14	2¼	0	72

Cubic, *or* Solid Measure.†

1728 cubic inches make 1 cubic foot.
27 cubic feet —— 1 cubic yard.
40 feet of round timber, or 50 feet of hewn timber —— 1 ton.
128 solid feet, that is, 8 feet in length, 4 in breadth, and 4 in height —— 1 cord of wood.

yd.	ft.	in.
340	18	1312
748	9	716
537	10	1012
681	12	120

yd.	ft.	in.
85	15	185
97	7	359
45	12	401
29	6	184

yd.	ft.	in.
37	12	94
77	11	88
35	14	79
67	4	56

Wine Measure.‡

4 gills make 1 pint, marked pts.
2 pints —— 1 quart, —— qts.
4 quarts —— 1 gallon, —— gal.
63 gallons —— 1 hogshead, —— hhd.

hhd.	gal.	qts.	pts.	gill.
350	40	3	1	2
135	23	1	1	1
986	17	2	0	3
456	13	1	1	0

hhd.	gal.	qts.	pts.	gill.
174	33	2	1	3
517	30	3	0	2
785	28	1	1	1
953	10	0	0	1

* Square measure is applied to things which have length and breadth without regard to thickness, or depth.

† Cubic measure is applied to things which have length, breadth, and thickness.—Note. A cube is a body consisting of six equal sides.

‡ *All distilled spirits*, cider, vinegar, oil, &c. are sold by wine measure.

Ale, *or* Beer Measure.*

2	pints	make 1	quart.
4	quarts	—— 1	gallon.
54	gallons	—— 1	hogshead.

hhd.	gal.	qts.	pts.
340	10	2	1
479	35	1	0
247	16	3	1
855	18	1	0

hhd.	gal.	qts.	pts.
485	24	3	0
387	15	2	1
875	14	1	1
730	16	3	0

Dry Measure.†

2	pints	make 1	quart,	marked qts.
2	quarts	—— 1	pottle,	—— pot.
2	pottles	—— 1	gallon,	—— gal.
2	gallons	—— 1	peck,	—— pk.
4	pecks	—— 1	bushel,	—— bush.
36	bushels	—— 1	chaldron,	—— ch.

ch.	bush.	pk.	gal.	pot.	qts.	pts.
36	14	3	1	0	1	1
29	15	1	0	1	1	0
27	7	2	1	0	1	1
13	12	3	0	1	0	1

ch.	bush.	pk.	gal.	pot.	qts.	pts.
14	21	2	0	1	0	1
17	15	1	1	0	1	0
24	9	3	1	1	1	1
19	5	0	1	0	1	0

Time.

60	seconds.	make 1	minute,	marked m.
60	minutes	—— 1	hour,	—— h.
24	hours	—— 1	day,	—— d.
7	days	—— 1	week,	—— w.
4	weeks	—— 1	month,	—— mo.
13	lunar months, or 12 solar months	—— 1	year,‡	—— yr.

d.	h.	m.	s.
3	16	45	15
5	4	10	20
6	4	5	25
4	13	15	45

w.	d.	h.	m.
2	5	18	30
1	3	3	15
3	6	7	12
0	4	3	30

yr.	mo.	w.	d.	h.	m.	s.
340	9	3	6	18	57	35
517	4	1	3	6	3	25
876	7	2	5	12	40	57
384	6	2	0	12	20	15

* The beer gallon contains 282, and the wine gallon 231 cubic, or solid inches. Milk is sold by the beer quart.

† This measure is applied to corn, seed, fruit, roots, salt, sand, coals, oysters, and all dry goods.

‡ According to our callender, § 365 days make a year; but the true solar year, or the time in which the earth performs one complete revolution round the sun, is 365 days, 5 hours, 48 minutes, 57 seconds. For this reason one day is added to February every fourth year, which is called Bissextile or leap year.

§ *Thirty days hath September, April, June, and November;* | *February twenty-eight alone, And all the rest have thirty-one.*

SUBTRACTION.

SUBTRACTION teaches to find the difference between any two numbers, by taking the *less* from the *greater*; and is both Simple and Compound.

SIMPLE SUBTRACTION

Teaches to find the difference of two numbers, which are of one name or denomination.

RULE 1*st*. Place the greater number uppermost, and the less directly under it, setting units under units, tens under tens, &c.

RULE 2*d*. Having properly stated the question, draw a line underneath; then, beginning with units, subtract, or take the less number from the greater, and set down the remainder, or difference.

RULE 3*d*. Borrow *ten*; that is, whenever the lower figure happens to be greater than the upper, *add ten* to the upper figure, and subtract the lower figure therefrom, and set down the remainder, always remembering, when you borrow in one place, to carry one to the next.

PROOF. Add the difference of two numbers to the least number; if the amount be equal to the greatest number, the work is right.

EXAMPLES.

	1	2	3
From	52365	87543	78567
Take	15423	31024	32785
Difference	36942		
Proof	52365		

In the first example, I say, three from five there remain two, which I set down; then, two from six, there remain four; then, four from three, I cannot, but four from thirteen, there remain nine; then, one to carry to five are six, six from two I cannot, but six from twelve, six remain; then, one to carry to one are two; two from five, three remain. I then draw a line, and add the remainder, or difference of the two numbers in the question, to the least number, or numbers subtracted; the amount of which, being equal to the greatest number, shows the work to be right.

4	5	6
83547 8	704580	900000
54306 8	085743	098765

7										8									
4	8	7	5	6	8	5	3	4	7	9	8	7	6	5	4	3	2	1	0
3	7	7	5	6	8	5	3	4	8	0	1	2	3	4	5	6	7	8	9

Application.

1st. Subtract two thousand, one hundred, and nineteen, from five thousand, two hundred, and twelve. 3093 Answer.

2d. A man is worth five thousand, eight hundred pounds; but, he owes three hundred and forty-eight pounds: how much is he worth when his debt is paid? £.5452 Answer.

3d. What is the difference between nine, and ninety-nine million? 98999991 Answer.

4th. If one be taken from ten thousand, what will then remain? 9999 Answer.

5th. A gentleman possessed fifteen thousand, eight hundred, and forty acres of land; but, he sold two thousand, three hundred, and fifty to one man;—four thousand, five hundred to another;—and, three thousand, two hundred, and twenty-five to a third;—how much had he left? 5765 Ans.

Compound Subtraction.

Compound Subtraction teacheth to find the difference between two sums of several denominations.

Rule 1st. Place the two sums in such a manner, as that each denomination may stand directly under that of the same name; the *greater* sum being above the *less*. Subtract the *less* sum from the *greater*, beginning with the lowest denomination, and set down the difference.

Rule 2d. Borrow in all denominations, the *same*, for which you carried, in Compound Addition.

Lawful Money.

	1					2			
	£.	s.	d.	q.		£.	s.	d.	q.
From	785	18	9	3	Borrowed	37	10	6	1
Take	357	14	7	1	Paid	13	14	9	3
Remain	428	4	2	2	Remain	23	15	8	2
Proof	785	18	9	3	Proof	37	10	6	1

Note. In case of borrowing, you may subtract the *lower number* from the *number borrowed*, and, to the difference, add the upper number; which is the same as *adding* the number borrowed to the *upper number*.

3 £.	s.	d.	q.	4 £.	s.	d.	q.	5 £.	s.	d.
8370	9	3	0	5911	13	10	2	835	12	$4\frac{1}{2}$
1987	8	4	3	2598	17	11	3	516	16	$2\frac{3}{4}$
								318	10	$1\frac{3}{4}$
								835	12	$4\frac{1}{2}$

6 £.	s.	d.	7 £.	s.	d.	8 £.	s.	d.	9 £.	s.	d.
89	11	$3\frac{1}{4}$	100	3	6	380	5	$7\frac{1}{4}$	8753	1	$10\frac{1}{2}$
33	13	$4\frac{1}{2}$	57	14	$8\frac{1}{2}$	197	15	8	308	12	$11\frac{1}{2}$

Federal Money.

The federal currency is of such nature, that all questions respecting it, whether in Addition, Subtraction, Multiplication, or Division, are wrought in the same manner as those of whole numbers.

Examples.

	1 dol.	cts.	m.	2 dol.	cts.	m.	3 dols.	cts.	m.
From	485,	50,	7	584,	16,	3	87,	37,	4
Take	379,	75,	5	199,	25,	5	58,	66,	8
Remain	105,	75,	2						
Proof	485,	50,	7						

	4 dol.	ct.	5 dol.	ct.	m.	6 dol.	ct.	m.
Lent	7858,	95	340,	12,	5,	850,	05	3
Received	3899,	75	149,	20,	0,	98,	07	6

Practical Questions in Lawful and Federal Money.

1st. A man borrows twenty-nine pounds, thirteen shillings, and four pence half penny; he pays nineteen pounds, fifteen shillings, and six pence three farthings; how much remains unpaid? £.9 17 $9\frac{1}{4}$ Ans.

2d. A man borrows one thousand, three hundred, eighteen dollars, twenty-five cents, five mills; but he pays five hundred *and eighty-nine* dollars, seventy-five cents, five mills: how *much remains* unpaid? dols. 728, 50 Ans.

3d. Subtract nine pence half penny, from thirty-five pounds.
£. 34 19 2½ Ans.

4th. Subtract five mills from twenty-four thousand dollars.
dols. 23999, 99, 5 Answer.

5th. What is the difference between one farthing and a thousand pounds? £. 999 19 11¼ Ans.

6th. A man is worth fourteen thousand, five hundred and sixty pounds, sixteen shillings and four pence; but he owes one man, two thousand three hundred and forty-six pounds, ten shillings and eight pence; to another, three thousand, five hundred and nine pounds, eighteen, and ten pence half penny; and, to a third, eight hundred and sixteen pounds, fourteen, and five pence half penny; how much will he have left after his debts are paid? £.7887 12 4 Answer.

7th. A man borrows, at one time, sixty-nine dollars, twenty-five cents; at another, forty-five dollars, forty cents; and, at another, thirty-seven dollars, seventy-five cents. He pays, at one time, twenty-eight dollars, twenty cents: at another, thirty-nine dollars, twenty-five cents; and, at another, forty five dollars. What sum is still due? dols. 39, 95 Ans.

Troy Weight.

lb.	oz.	pwt.	gr.
875	6	14	19
387	9	16	15

lb.	oz.	pwt.	gr.
724	3	5	7
175	8	13	15

Subtract twelve grains, fifteen pwt. eight ounces, nineteen pounds, from forty-six pounds, two ounces, three pwt. eight grains. 26lb. 5oz. 7pwt. 2ogr. Ans.

Avoirdupois Weight.

T.	cwt.	qr.	lb.	oz.	dr.
45	12	2	23	9	7
17	14	3	25	8	9

T.	cwt.	qr.	lb.	oz.	dr.
18	17	1	18	12	13
5	17	1	18	12	15

Subtract eight drams, ten ounces, from nine tons, one quarter. 9T. 0cwt. 0qr. 27lb. 5oz. 8dr. Ans.

Apothecaries' Weight.

lb.	℥	ʒ	℈	gr.
89	5	4	1	11
38	10	5	2	13

lb.	℥	ʒ	℈	gr.
78	9	3	0	11
19	9	6	1	7

Suppose I buy fifteen pounds, five ounces, three drams, one scruple, thirteen grains; and sell ten pounds, eleven ounces, six drams, two scruples, eighteen grains of the same; what have I left? 4lb. 5℥ 4℥ 3ʒ 1ʒ 5gr. Answer.

Cloth Measure.

yd.	qr.	na.	E.Fl.	qr.	na.	E.E.	qr.	na.	E.Fr.	qr.	na.
385	1	2	98	1	0	74	3	1	88	4	2
179	2	3	59	2	3	61	3	2	18	5	3

What is the difference between three nails and twenty-five yards? 24yds. 3qr. 1 na. Answer.

Long Measure.

mile.	fur.	rod.	yd.	ft.	in.	bar.	mile.	fur.	rod.	yd.	ft.	in.	bar.
35	4	20	$31\frac{2}{2}$	1	4	1	17	5	12	4	0	8	2
27	5	38	4^{2}	2	9	0	8	5	30	$3\frac{1}{2}$	1	10	1

Subtract two barley-corns, one foot, twenty rods, three miles, from eight miles, two furlongs, one yard, nine inches.
5 miles, 1 fur. 20 rods, 0yd. 2ft. 8in. 1bar. Answer.

Square Measure.

A.	rod.	yd.	ft.	in.	A.	rod.	yd.	ft.	in.
540	100	211	5	110	48	29	15	4	123
187	156	29^{4}	8	134	36	80	$25\frac{1}{4}$	5	124

A man has two farms. The first contains three hundred and forty acres, seventy-five rods; the second contains eighty-two acres, ninety rods; how much more is the first than the second? 257 A. 145 rod. Answer.

Wine Measure.

hhd.	gal.	qts.	pts.	gill.	hhd.	gal.	qts.	pts.	gill.
387	35	2	1	2	845	15	1	0	1
158	59	3	0	3	267	50	2	1	2

Bought a cask of brandy containing fifty five gallons, two quarts; sold twenty-eight gallons, one pint, two gills of the same; how much remains unsold? 27gal. 1qt. opt. 2 gill. Ans.

Beer Measure.

hhd.	gal.	qts.	pts.	hhd.	gal.	qts.	pts.
487	18	2	0	549	13	1	1
287	51	3	1	451	48	2	0

What is the difference between one pint, and one hundred and thirty-five hogsheads ?

134 hhd. 53gal. 3qts. 1pt. Ans.

Time.

yr.	mo.	w.	d.	h.	m.	s.	yr.	mo.	w.	d.	h.	m.	s.
75	8	2	5	15	45	57	36	10	3	4	12	10	15
48	11	3	5	16	47	59	19	12	3	6	18	50	20

Suppose a man let himself to work five years ; but stays only three years, nine months, one week, four days ; how long before his time is out does he go away ? 1 yr. 3 mo. 2w. 3d. Answer.

2d. Subtract forty-five minutes, fifteen seconds, from ten years. 9yr. 11mo. 3w. 6d. 23h. 14m. 45s. Ans.

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

Multiplication is the increasing of any number, by *so many* of itself, as there are units in *that* number by which it is increased, or multiplied.

Multiplication is both simple and compound.

Simple Multiplication teacheth to multiply any two numbers into each other, which are of one denomination.

In multiplication, there are three things to be considered, viz.

1st. The multiplicand, or number to be multiplied.

2d. The multiplier, or number to multiply by.

3d. The product, which is the result of two numbers when multiplied together, and is the answer to the question.

RULE. Place the multiplicand (which is commonly the largest number) uppermost, and the multiplier underneath; setting units under units, tens under tens, &c. then draw a line, and proceed to multiply, beginning with units, and set down the product, observing to carry *one* for every *ten*, as in Simple Addition.

PROOF. Multiplication may be proved, 1st. by inverting the order of the multiplier and multiplicand; that is, make the multiplicand the multiplier, and proceed to multiply in the usual way; the product being like to the product before the question was inverted, shows the work to be right. 2d, by dividing the product by the multiplier; the quotient being equal to the multiplicand, shows the work to be right.* But, the most ready method of proving multiplication, is, by casting out the nines,† thus: 1st, cast the nines out of the multiplicand, and set the overplus at the right hand of a cross, as you see in the example. 2d, cast the nines out of the multiplier, and set the remainder at the left hand of the same. 3d, multiply the figures at the right and left of the cross together, cast the nines out of their product, and set the remainder a-top. Lastly, cast the nines out of the product, and set the remainder at the bottom; if the top and bottom figures are alike, the work is supposed to be right.

EXAMPLE.

4 8 3 4 Multiplicand
2 5 2 Multiplier.

9 6 6 8 — 7
1 4 5 0 2 — Proof. 7 × 1
9 6 6 8 — 7

1 1 2 1 4 8 8 Product.

* As it is supposed the learner is not acquainted with division, he cannot at first, put this method in practice.

† A question may prove by this method, when the work is not right; but, this will not happen, unless there are two wrong figures in the work, one of which must be just as much too large as the *other is too small, which is rarely the case.*

CASE I. When the multiplier does not exceed 12, multiply each figure of the multiplicand by the multiplier, beginning with units, and set the product in one line, placing the unit figure of the product directly under the unit figure of the multiplier.

1	2	3	4
5 4 3 7 8	9 5 6 8 7	3 4 6 2 5	5 8 6 3 5
2	3	4	5
Product.			

5	6	7
2 7 9 6 8	3 3 4 4 5	7 8 6 5 4
6	7	8

8	9	10
9 8 7 6 5	4 3 2 1 9	4 8 6 7 5 4 8 5 7
9	10	11

11	12
3 7 5 6 5 8 9 7 8	8 5 6 7 9 4 3 7 9 5 6 8 4 3
12	9

CASE II. When the multiplier is any number over 12, multiply each figure of the multiplicand by each figure of the multiplier, respectively; set the first figure of each product directly under *that* by which you are multiplying; lastly, add the several products together, the sum will be the whole product.

1	2	3
8 5 7 3 2	3 8 6 9 7	1 8 7 5 4
2 4	1 8	3 8
3 4 2 9 2 8		
1 7 1 4 6 4		
Prod. 2 0 5 7 5 6 8	6 9 6 5 4 6	7 1 2 6 5 2

4	5	6
5 1 2 8 3	7 3 1 2 6	5 4 3 0 2
5 4	7 2	9 6
Prod. 2 7 6 9 2 8 2	5 2 6 5 0 7 2	5 2 1 2 9 9 2

7	8	9	10
30578	58974	14065	8754366
823	414	894	4334
11	**12**		**13**
8750322	7543822		3543145
2462	33452		99999
		3543104568	86

CASE III. When there are cyphers at the right hand of the multiplier, place the first significant figure of the multiplier under the unit figure of the multiplicand, &c. multiply by the significant figures only, and bring down the cyphers at the right hand of the product.

	1	2	3
	485	8357	3786
	240	1200	3600
	19400		
	970		
Pro.	116400	10028400	

4	5
58634	370584
953000	6390000

CASE IV. When there are cyphers between the significant figures of the multiplier, omit them, and multiply by the significant figures only; observing to set the first figure of each product under that by which you are multiplying.

1	2	3
38574	85743	53468
405	7006	30403
	514458	
	600201	
Prod.	6007154458	

4	5	6
378546	7563	47659
40054	8070	3602

CASE V. When there are cyphers at the right hand of the multiplicand and multiplier both, place the significant figures of the multiplier directly under those of the multiplicand; multiply the significant figures only, and bring as many cyphers to the right hand of the product, as there are in the multiplicand and multiplier both.

1	2
378500	85743000
34000	385000
15140	
11355	
Prod. 12869000000	

3	4
5734800000	385620700
30560	6803000

CASE VI. To multiply by 10, 100, 1000, 10000, &c. place the cyphers in the multiplier at the right hand of the multiplicand, and the work is done.

EXAMPLES.

Multiply 3857, by 10.	38570 Answer.
Multiply 895, by 100.	89500 ditto.
Multiply 573, by 1000.	573000 ditto.
Multiply 987, by 10000.	9870000 ditto.
Multiply 80759, by 100.	8075900 ditto.
Multiply 10000, by 1000.	10000000 ditto.

Practical Questions.

1st. Multiply four hundred and eighty-five by two hundred and forty. 116400 Ans.

2. Suppose an orchard contain three hundred and thirteen trees, and each tree produce fifteen bushels of apples; how many bushels will the whole orchard produce? 4695 Ans.

3d. How many squares of glass are there in an hundred and twenty-four windows, each window containing forty-squares? 4960 Answer.

4th. Suppose a regiment, consisting of three hundred and sixty men, be employed four months, each man to receive at the rate of nine dollars per month; what sum of money will pay the whole regiment, at the end of the time? 12960dol. Ans.

5th. A man owns seventeen houses, each house is valued at four hundred and ninety-six pounds; what are they all worth? £.8432 Ans.

6th. Multiply three hundred, seventy-eight thousand, five hundred, by thirty-four thousand. 12869000000 Ans.

7th. A man sells a farm containing three hundred and fourteen acres, for twenty-five dollars per acre; what does the whole farm amount to? 7850 dol. Ans.

DIVISION.

DIVISION teacheth to find how often one number is contained in another; or, to separate any number, or quantity, into any number of equal parts; and is both simple and compound.

SIMPLE DIVISION

Teacheth to divide one number by another, each of which must be of only one denomination.

Division consists of four parts, viz.

1st. The Dividend, or number to be divided.

2d. The Divisor, or number to divide by.

3d. The Quotient, which is the answer to the question, and shows the number of times the divisor is contained in the dividend.

4th. The Remainder;* which is of the same name with the dividend, and is always less than the divisor.

PROOF. Multiply the divisor and quotient together, and add in the remainder (if there be any) to the product, which, if the work be right, will be a sum equal to the dividend.

RULE. Having properly stated the question, first, inquire how many times the divisor is contained in a certain number of the first left hand figures of the dividend, (which figures *alone* must be a sum *at least* equal to the divisor,) which, being ascertained, place the figure in the quotient: then, multiply the divisor by the quotient figure, and set the product directly under that portion of the dividend which you divided, and subtract it therefrom; to the right hand of the remainder, bring down the next figure of the dividend, and inquire how many times the divisor is contained in that number; when found, place the figures in the quotient as before, and multi-

* The remainder is very uncertain, there sometimes being one, and sometimes none.

Note. The remainder, after dividing, is always the numerator, to a proper fraction, the divisor being the denominator. This fractional part belongs to the quotient.

ply the divisor by it, and set the product under the last divided number; subtract as before, and to the remainder bring down the next figure of the dividend; thus proceed, till every figure of the dividend is brought down.

Note. If, after a figure is brought down, the number be *less* than the divisor, place a cypher in the quotient, and bring down another figure.

EXAMPLE.

Divisor.	Divid.	Quotient.	Proof.	
24)7	8 1	6(3 2 5	325	Quotient.
7	2		24	Divisor.
	6 1		1300	
	4 8		650	
	1 3 6		7800	
	1 2 0		16	Remainder.
	1 6	Remainder.	7816	Dividend.

In the above example, I first inquire how many times twenty four there are in seventy-eight, which I find to be three; I then place 3 in the quotient, and multiply the divisor 24 by it, and place the product 72, under 78, the number divided; I then subtract 72 from 78, and find the remainder to be 6; I then bring down the next figure of the dividend, which is 1, and inquire how many times 24 there are in 61, which being found, I place the figure in the quotient as before; I proceed in the same manner, till every figure of the dividend is brought down. Then, to prove the work, I multiply the quotient and divisor together; and, to the product, add the remainder 16; the sum, being equal to the dividend, shows the work is right.

1	2	3
3)5478(1826	4)6538(1634	5)7865(1573
3	4	5
24	25	28
24	24	25
7	13	36
6	12	35
18	18	15
18	16	15
	2	

4	5	6	7
6)45873(	7)95864(	9)12853(	12)35786(

8	9	10	11
15)93758(	18)19537(	24)75863(	48)15857(
12	13	14	
85)98765(	123)29857(	479)59076(	
15	16	17	
577)89654(	1796)485987(	8938)5957600(	

CASE II. When there are cyphers at the right hand of the divisor, cut them off; likewise cut off the same number of figures from the right hand of the dividend, and proceed to divide as in the first case.

Note. The figures which were cut off from the dividend, must be placed at the right hand of the remainder.

EXAMPLES.

1	2	3
36|0)146|9(4	24|00)1059|12(44	5|00)687|54(
144	96	
29 rem.	99	
	96	
	312 rem.	

4	5
85|00)587|50(	38|000(78765|300(
6	**7**
8598|00)84567|85(	378|0(48569|7(

CASE III. To divide by 10, 100, 1000, 10000, &c. cut off so many figures from the right hand of the dividend as there are cyphers in the divisor; the figures cut off will be the remainder, and the left hand figures will be the quotient.

EXAMPLES.	quot.	rem.	
Divide 7898, by 10.	789	8	Answer.
Divide 3874, by 100.	38	74	ditto.
Divide 7586, by 1000.	7	586	ditto.
Divide 398765, by 10000.	39	8765	ditto.

Short Division.

Short Division is, when the divisor does not exceed 12; and is performed in the usual way, only the several steps pursued by the assistance of figures in *other cases* are omitted in *this*, and the work wrought entirely by the mind.

RULE. Separate the divisor from the dividend in the usual way; then draw a line under the dividend, and inquire how many times the divisor is contained in one or more figures of the dividend, which, being found, place the first quotient figure directly under the unit figure of that portion of the dividend which you divide; then, mentally, multiply the divisor

by the quotient figure, and subtract the product from the divided number; to the remainder bring the next figure of the dividend, and inquire how many times the divisor is contained in that number; when found, proceed as before. Thus continue, till every figure of the dividend is divided.

Note. If there be a remainder after all the figures of the dividend are divided, strike a short line at the right hand of the quotient, at the end of which place the remainder.

EXAMPLES.

1	2	3
2)85763	3)85765	3)13656912
Quot. 42881—1 rem.	28588—1	4552304

4	5	6	7
5)73855	4)183796	6)138547	7)346756
8	9	10	11
8)49725	9)65548	11)35728	12)58536

Practical Questions.

1st. Divide six thousand, seven hundred and sixty-four, by nineteen. 356 Answer.

2d. Divide six thousand, seven hundred and sixty-four, by three hundred and fifty six. 19 Answer.

3d. If five hundred and fifty-five dollars be divided equally among fifteen men, what will each have? 37 dol. Answer.

4th. What is the third part of 3669? 1223 Answer.

5th. What is the fourth part of 87856? 21964 Answer.

6th. What is the twenty-fourth part of 2688? 112 Ans.

7th. What is the half of 98570? 49285 Answer.

8th. What is the hundred and fiftieth part of 2550? 17 Answer.

9th. A gentleman bought 387 acres of land, for which he gave 8514 dollars. What did it cost per acre? 22 dol. Ans.

10. A gentleman dying, left 16536 dollars, to be divided in the following manner, viz.—To his widow he gave one third part; and the remainder was to be divided equally among four children; what did each have?

5512 dol. widow's portion,
2756 dol. each child's portion, } Ans.

REDUCTION BY MULTIPLICATION.

Reduction by Multiplication* teacheth to bring a high denomination to an equivalent value in a low denomination.

D

* This is called reduction descending.

RULE. Multiply each descending denomination by as many of the next *lower* denomination as make *one* in *that* which you are about to reduce;—thus proceed till the question is brought into the denomination required.

PROOF. Divide the last product by the last multiplier, and that quotient by the next, &c. If the last quotient be equal to the first multiplicand, the work is right.

£ EXAMPLES.

In 434, how many farthings?

20

8680 shillings.
12

104160 pence.
4

416640 farthings.—Answer.

Proof. 4)416640(104160(8680(434
12) 20)
4 96 80
16 81 68
16 72 60
6 96 80
4 96 80
24 0
24
0

By short division.

4)416640 farthings.
12)104160 pence.
2|0) 868|0 shillings.
434 pounds.

Note. When there are several denominations in the question, as for instance, pounds, shillings, &c. bring in the odd shillings when multiplying by 20, the odd pence when multiplying by 12, &c. Proceed in like manner with all questions of this nature.

£. s. d.

In 85 12 8 how many farthings?

20

Shillings. 1712
12

Pence. 20552
4

Farthings. 82208 Answer.

Proof. 4)82208
12)20552
2|0) 171|2—8
£.85 12 8

N. B. When there is a remainder after dividing, it is always *of the same* denomination with the dividend.

Questions.		£.	s.	d.		Answers.
1	Reduce	8598	0	0	to farthings.	8254080
2	———	340	9	8	to pence.	81716
3	———	103	15	7¼	to farthings.	99628
4	———	529	18	9½	to farthings.	508742
5	———	17	13	4¾	to farthings.	16963

Troy Weight.

		lb.	oz.	pwt.	gr.		
1	Reduce	847	0	0	0	to grains.	1998720
2	———	210	8	12	0	to penny-wts.	50572
3	———	1[illegible]7	9	15	18	to grains.	678618
4	———	18	5	9	21	to grains.	106317

Avoirdupois Weight.

		T.	cwt.	qr.	lb.	oz.	dr.		
1	Reduce	3	0	0	0	0	0	to drams.	1720320
2	———	0	12	1	18	0	0	to ounces.	22240
3	———	1	15	2	7	0	0	to pounds.	3983

Apothecaries' Weight.

		lb	℥	ʒ	℈	gr.		
1	Reduce	118	0	0	0	0	to grains.	679680
2	———	15	7	3	0	0	to drams.	1499
3	———	11	5	4	1	17	to grains.	66037
4	———	8	9	5	0	0	to scruples.	2535

Cloth Measure.

		yds.	qr.	na.		
1	Reduce	345	0	0	to nails.	5520
2	———	83	3	0	to quarters.	335
3	———	14	1	3	to nails.	231

Long Measure.

		mile.	fur.	rod.	yd.	ft.	in.	bar.		
1	Reduce	378	0	0	0	0	0	0	to barley-corns.*	71850240
2	———	27	5	18	3	1	8	1	to barley-corns.†	5262037
3	———	38	3	9	0	0	0	0	to inches.	2433222
4	———	16	0	0	0	0	0	0	to yards.	28160

Square Measure.

		A.	rod.	yd.	ft.	in.		
1	Reduce	130	0	0	0	0	to inches.‡	815443200
2	———	37	40	0	0	0	to yards.	180290

* 1760 yards make one mile; therefore when the question is miles only, multiply the miles by 1760; the product will be yards.

† In reducing rods to yards, in long measure, multiply the rods by 5½ then add half the multiplicand to the product, which sum will be the mutiplicand, multiplied by 5 1-2.

‡ In reducing rods to yards, in square measure, multiply the rods by 30¼ then add one quarter of the *multiplicand to the* product.

Cubic Measure.

Questions.		Answers.
1	Reduce 40 yards to inches.	186240
2	——— 3 tons of round timber to inches.	207360
3	——— 2 tons of hewn timber to inches.	172800
4	——— 5 cords of wood to inches.	1105920

Wine Measure.

		hhd.	gal.	qts.	pts.	gill.		
1	Reduce	24	0	0	0	0	to gills.	48384
2	———	15	19	3	1	2	to gills.	30878
3	———	9	25	1	0	0	to pints.	4738

Beer Measure.

		hhd.	gal.	qts.	pts.		
1	Reduce	35	0	0	0	to pints.	15120
2	———	12	15	2	1	to pints.	5309
3	———	10	17	0	0	to gills.	17824

Time.

1. In 45 years, how many seconds? 1419120000

Note. I call 365 days a year, although it falls short a little, yet it is exact enough for common purposes.

2. In 16 years, 5 months, how many minutes?

yr.	mo.
16	5
13	
53	
16	
213	
4	
852	
7	
5964	
24	
23856	
11928	
143136	
60	

Min. 8588160 Answer.

3. Reduce 1796 years to seconds.

1796 yrs.
365
8980
10776
5388
Days. 655540
24
2622160
1311080
Hours. 15732960
60
Min. 943977600
60
Sec. 56638656000 Ans.

Federal Money.

CASE I. To reduce dollars to cents.

RULE. Place two cyphers at the right hand of the dollars, *and the work is* done.

EXAMPLES.

1. In 389 dollars how many cents? 38900 Answer.
2. Reduce 4857 dollars to cents. 485700 ———

CASE II. To reduce dollars to mills.

RULE. Annex three cyphers to the dollars.

EXAMPLES.

1 Reduce 389 dollars to mills. 389000 Answer.
2 ——— 857 dollars to mills. 857000 ———

CASE III. To reduce dollars and cents to cents.

RULE. Remove the comma from between the dollars and cents, and the work is done.

EXAMPLES.

1 Reduce dol. 385, 50 to cents. 38550 Answer.
2 ——— — 593, 08 to cents. 59308 ———

CASE IV. To reduce dollars and cents to mills.

RULE. Remove the comma as in Case 3d, and annex one cypher to the right hand.

EXAMPLES.

1 Reduce dol. 35, 75 to mills. 35750 Answer.
2 ——— — 85, 03 to mills. 85030 ———
3 ——— — 70, 25 to mills. 70250 ———

CASE V. To reduce cents to mills.

RULE. Annex one cypher to the cents.

Reduce 66 cents to mills. 660 Answer.

CASE VI. To reduce dollars, cents and mills to mills.

RULE. Remove the commas from between the dollars and cents, and cents and mills, and the whole sum is mills.

EXAMPLES.

1 Reduce dol. 38, 75, 7 to mills. 38757 Answer.
2 ——— — 49, 03, 5 to mills. 49035 ———
3 ——— — 77, 66, 3 to mills. 77663 ———

Note 1*st*. When you would bring cents into dollars, point off the two right hand figures for cents; the left hand figures are dollars.

EXAMPLES.

1. In 38575 cents, how many dollars? dol. 385, 75 Ans.
2 In 38705 cents, how many dollars? — 387, 05 —

Note 2d. To bring mills into dollars, cents, &c. point off the first right hand figure for mills, the two next for cents; the left hand figures are dollars.

EXAMPLES.

1. In 85697 mills, how many dollars, cents, &c. ?
dol. 85, 69, 7 Answer.
2. In 387543 mills, how many dollars, cents, &c. ?
dol. 387, 54, 3 Ans.
3. In 586085 mills, how many dollars, cents, &c. ?
dol. 586, 08, 5 Ans.

REDUCTION BY DIVISION.

Reduction by Division* teacheth to bring a low denomination to its equivalent value in higher denominations ; and is the reverse of Reduction by Multiplication, and is proved by it.

RULE. Divide the *lowest* denomination given, by so many of *that lowest* as make *one* in the next higher denomination ; thus proceed with every ascending denomination, till you have brought the question into the denomination required.

EXAMPLES.

1. In 416640 farthings, how many pounds ?

	12)	20)	£.
4)416640(	104160(	8680(	434 Answer.
4	96	80	
16	81	68	
16	72	60	
6	96	80	
4	96	80	
24	0		
24			
0			

By short division.

4)416640 farthings.
12)104160 pence.
2|0) 868|0 shillings.
434 pounds. Ans.

2. In 16963 farthings, how many pounds, shillings, &c. ?

	12)	20)	£. s. d.
4)16963(	4240 (	353(	17 13 $4\frac{3}{4}$ Ans.
16	36	20	
9	64	153	
8	60	140	
16	40	13	
16	36		
3	4		

Or thus : 4)16963
12) 4240—3
2|0) 353—4
Ans. £. 17 13 $4\frac{3}{4}$

3. In 99628 farthings, how many pounds, shillings, &c. ?
£. 103 15 7 Answer.

* This is called reduction ascending.

4. In 508742 farthings, how many pounds, shillings, &c.?
£. 529 18 9½ Ans.

Note. The foregoing and following questions are a proof to those in reduction by multiplication.

5. In 1998720 grains, how many pounds Troy? 347 Ans.
6. In 678618 grains, how many pounds, ounces, &c. Troy?
117lb 9oz. 15pwt 18gr Answer.
7. In 1720320 drams, how many tons 3 tons Answer.
8. In 22240 ounces, how many cwt. quarters, &c.?
12cwt. 1qr. 18lb. Ans.
9. In 679680 grains, how many pounds Apothecaries' wt.?
118lb Answer.
10. In 2535 scruples, how many pounds, ounces, &c.?
8lb. 9ʒ 5ʒ Answer.
11. In 5520 nails, how many yards? 345 yds. Ans.
12. In 231 nails, how many yards, quarters, &c?
14yds 1 qr. 3 na. Ans.
13. In 71850240 barley-corns, how many miles? 378 Ans.

Note. In the last question I bring barley-corns to yards, and then divide by 1760, the number of yards in a mile.

14. In 28160 yards, how many miles? 16 Ans.
15. In 815443200 square inches, how many acres?
180 Ans.

Note. In the last question, I bring inches to yards, and then divide by 4840, the number of yards in an acre.

16. In 207360 cubic inches, how many tons of round timber? 3 tons Ans.
17. In 172800 cubic inches, how many tons of hewn timber? 2 tons Answer.
18. In 1105920 cubic inches, how many cords of wood?
5 cords Answer.
19. In 48384 gills, how many hogsheads wine? 24 Ans.
20. In 4738 pints, how many hogsheads, gallons, &c. wine? 9hhd. 25gal. 1qt. Ans.
21. In 15120 pints, how many hogsheads beer? 35 Ans.
22. In 17824 gills, how many hogsheads, gallons, &c. beer?
10hhd. 17gal. Answer.
23. In 1419120000 seconds, how many years?* 45 Ans.
24. In 56638656000 seconds, how many years?* 1796 Ans.
25. In 8588160 minutes, how many lunar years?
16yr. 5mo. Answer.
26. In 87950 cents, how many dollars and cents?
dol. 879, 50 Ans.
27. In 53987 mills, how many dollars, cents, &c.?
dol. 53, 98, 7. Ans.

** In these questions I bring seconds to days, and then divide by 365.

Multiplication of Federal Money.

Case I. When the price is *dollars* only, multiply the whole quantity by the price of one yard, pound, &c. the product will be the price of the whole quantity, in dollars.

Examples.

1. To what will 385 acres of land amount, at 25 dollars per acre?

385
25
1925
770
9625 dol. Answer.

2. To what will 45 barrels of flour amount, at 14 dollars per barrel?

45
14
180
45
630 dol. Answer.

3. What will 18½ yds. come to, at 4 dollars per yard?

18½
4
72 dol. price of 18 yds.
2 dol. price of ½ yd.
74 dol. price of 18½ yds.

4. What will 25¼ yds come to, at 8 dollars per yard?

25¼
8
200 dol. price of 25 yds.
2 dol. price of ¼ yd.
202 dol. price of 25¼ yds.

Questions.	yards, pounds, &c.		dol.	Answers. dol.
5.	398	at	12 per yd.	4776.
6.	130	at	10	1300.
7.	95	at	9	855.
8.	47	at	7	329.
9.	74	at	8	592.
10.	29½	at	6	177.

Case II. When the price is cents only, multiply the whole quantity by the price of one yard, pound, &c. then cut off the two right hand figures of the product for cents, the left hand figures are dollars.

Examples.

1. What will 125 yards come to, at 75 cents per yd.

125
75
625
875
dol. 93,75 Ans.

2. To what will 216 yards amount, at 25 cents per yard?

216
25
1080
432
dol. 54,00 Ans.

Questions.	yards, pounds, &c.		cents.		Answers. dol. cts.
3.	389	at	66	per yd.	256, 74.
4.	132	at	50		66, 00.
5.	830	at	25		207, 50.
6.	100	at	49		49, 00.
7.	395	at	56		221, 20.
8.	84	at	16		13, 44.
9.	15	at	87		13, 05.
10.	7	at	50		3, 50.
11.	5	at	99		4, 95.
12.	9	at	75		6, 75.

Case III. When the price is mills only, multiply the whole quantity by the price of one yard, pound, &c. then point off the first right hand figure of the product for mills, the two next for cents; the left hand figures are dollars.

Examples.

1. To what will 385 pounds of chalk amount, at 9 mills per pound?

385
9

dol. 3, 46, 5 Answer.

2. To what will 475 yards amount, at 8 mills per yard?

475
8

dol. 3, 80, 0 Answer.

3. Suppose a man worth 8756 dol. and his tax 3 mills on the dollar; what will his whole tax amount to?

8756
3

dol. 26, 26, 8 Answer.

4. To what will 5867 yards amount, at 5 mills per yard?

5867
5

dol. 29, 33, 5 Answer.

Questions.	yds. pounds, &c.		mills.		Answers. dol. cts. m.
5.	389	at	7	per yard.	2, 72, 3.
6.	154	at	6		92, 4.
7.	755	at	8		6, 04, 0.
8.	446	at	3		1, 33, 8.
9.	570	at	5		2, 85, 0.
10.	84	at	4		33, 6.
11.	98	at	9		88, 2.

Case IV. When the price is dollars and cents, place the unit figure of the quantity under the unit figure of the cents,

c. and proceed as in simple multiplication; point off the vo right hand figures of the product for cents; the left hand gures are dollars.

Note. When the cents are expressed by units only, the ten's ace must be supplied with a cypher.

Examples.

1. What will 253 yds. come , at 5 dollars. 12 cents per ird?

dol. cts.	
5, 12	
253	
1536	
2560	
1024	
dol. 1295, 36	Answer.

2. What will 498 yds. come to, at 3 dollars, 5 cents per yard?

dol. cts.	
3, 05	
498	
2440	
2745	
1220	
dol. 1518, 90	Answer.

Questions.	yds. pounds, &c.		dol. cts.	Answers. dol. cts.
3.	598	at	4, 25 per yd.	2541, 50.
4.	150	at	3, 16	474, 00.
5.	980	at	7, 09	6948, 20.
6.	$14\frac{1}{2}$	at	10, 50	152, 25.
7.	45	at	1, 06	47, 70.
8.	712	at	18, 75	13350, 00.
9.	94	at	2, 08	195, 52.
0.	$25\frac{1}{2}$	at	2, 66	67, 83.
1.	$84\frac{1}{4}$	at	1, 20	101, 10
2.	$26\frac{1}{4}$	at	2, 40	64, 20.
3.	$12\frac{1}{2}$	at	1, 25	15, $62\frac{1}{2}$.

Case V. When the price is cents and mills, or dollars, nts and mills, place the unit figure of the quantity under the ills, &c. and proceed as in simple multiplication; point off e first right hand figure of the product for mills, the two next r cents; what then remains on the left hand are dollars.

Note. When cents are expressed by units only, the place of ns must be supplied with a cypher.

Examples.

1. What will 324 yards come , at 3 dollars, 25 cents, 6 mills r yard?

2. What will 453 yards come to, at 84 cents, 7 mills per yard?

dol.	ct.	m.
3,	25,	6
		324
		13024
		6512
		9768
dol.	1054,	94, 4 Answer.

ct.	m.
84,	7
	453
	2541
	4235
	3388
dol.	383, 69, 1 Answer.

Questions.				Answers.
	yds. pounds, &c.		dol. ct. m.	dol. ct. m.
3.	785	at	4, 50, 7 per yard.	3537, 99, 5.
4.	356	at	25, 08, 6	8930, 61, 6.
5.	95	at	13, 19, 9	1253, 90, 5.
6.	94	at	6, 18, 5	581, 39, 0.
7.	78	at	9, 33, 8	728, 36, 4.
8.	45	at	75, 5	33, 97, 5.
9.	183	at	20, 7	37, 88, 1.
10.	15	at	7, 25, 3	108, 79, 5.

11. To what will 859 pair of shoes amount, at one dollar, eight cents, five mills per pair? dol. 932, 01, 5 Answer.

Compound Multiplication.

Compound Multiplication is, when the multiplicand consists of several denominations, and is an excellent rule in finding the amount of goods, when the price is in lawful money.

Rule. Place the multiplier under the lowest denomination, and carry for the same, as in addition of lawful money.

Case I. When the quantity does not exceed 12, multiply the price of one yard, pound, &c. by the whole quantity; the product will be the answer.

Examples.

1. What will 3 yards come to, at 1 pound, 6 shillings and 8 pence per yard?

£.	s.	d.
1	6	8
		3
£. 4	0	0 Ans.

2. What will 5 yards come to, at 1 pound, 10 shillings and 3 pence half penny per yard?

£.	s.	d.
1	10	3½
		5
£. 7	11	5½ Ans.

In the second example, I say, five half pence are two pence half penny; I set down the half penny, and carry two; then, five times three are fifteen, and two I carry are seventeen pence; I set down five, and carry one; then five times ten are fifty, and one I carry are fifty-one shillings; I set down eleven, and carry two; then, five times one are five, and two I carry are seven pounds.

Questions.	yds.	pounds, &c.		£. s. d.		Answers. £. s. d.
3.		4	at	1 8 6	per yd.	5 14 0.
4.		2	at	1 13 4		3 6 8.

Case II When the quantity is any number in the multiplication table, over twelve, multiply the price of one yard, pound, &c. by those two numbers, which, when multiplied together, will produce the given quantity.

Examples.

1. What will 15 yards come to, at 1 pound, 3 shillings, and 4 pence half penny per yard?

£.	s.	d.	
1	3	$4\frac{1}{2}$	
		5	
5	16	$10\frac{1}{2}$	price of 5 yds.
		3	
£.17	10	$7\frac{1}{2}$	price of 15 yds.

2. What will 24 yards come to, at 8 shillings and 6 pence three farthings per yard?

£.	s.	d.	
0	8	$6\frac{3}{4}$	
		6	
2	11	$4\frac{1}{2}$	price of 6yds.
		4	
£.10.	5	6	price of 24 yds.

Questions.	yds.	pounds, &c.		£.	s.	d.		Answers. £.	s.	d.
3.		18	at	1	7	$2\frac{1}{2}$	per yd.	24	9	9
4.		33	at	1	13	4		55	0	0

Case III. When the quantity is such, that no two numbers multiplied together will produce it exactly, or when there are parts of a yard, pound, &c. in the question, multiply as in Case 2, by two such numbers as come nearest to the given quantity; then add or subtract the price of the odd yards, or parts of a yard, pound, &c. as the case may require.

Examples.

1. What will 17 yds. come to, at 1 pound, 3 shillings and 4 pence per yard?

2. What will $19\frac{1}{2}$ yds. come to, at 8 shillings and 6 pence half penny per yard?

£.	s.	d.		£.	s.	d.	
1	3	4		0	8	6½	
		4				10	
4	13	4	price of 4 yds.	4	5	5	price of 10yds.
		4				2	
18	13	4	price of 16 yds.	8	10	10	price of 20 yds.
add 1	3	4	price of 1 yd.	subtr.	4	3¼	price of ½ yd.
£.19	16	8	price of 17 yds.	£.8	6	6¾	price of 19½yds.

Questions.	yds. pounds, &c.		£.	s.	d.		£.	s.	d.
3.	26	at	0	7	5	per yd.	9	12	10.
4.	30½	at	0	8	6		12	19	3.

Answers.

Case IV. When the quantity is any number of hundreds under thirteen, find the price of one hundred by Case 2d, then multiply the price of one hundred by so many as there are hundreds in the question.

Examples.

1. What will 300 yds. come to, at 1 pound, 3 shillings, and 4 pence per yard?

£.	s.	d.	
1	3	4	
		10	
11	13	4	price of 10 yds.
		10	
116	13	4	pr. of 100 yds.
		3	
£.350	0	0	pr. of 300yds.

2. What will 400 yds. come to, at 6 shillings and 3 pence half penny per yard?

£.	s.	d.	
0	6	3½	
		10	
3	2	11	price of 10yds.
		10	
31	9	2	pr. of 100yds.
		4	
£.125	16	8	pr. of 400yds.

Questions.	yds. pounds, &c.		£.	s.	d.		£.	s.	d.
3.	500	at	0	8	0	per yd.	200	0	0.
4.	600	at	1	2	7½		678	15	0.

Answers.

CASE V. When the quantity is any number of thousands under thirteen, find the price of one thousand by Case 4th, then multiply the price of one thousand by so many as there are thousands in the question.

EXAMPLES.

1. What will 3000 yds. come to, at 1 pound, 2 shillings and 3 pence per yard?

£.	s.	d.	
1	2	3	
		10	
11	2	6	price of 10 yds.
		10	
111	5	0	price of 100 yds.
		10	
1112	10	0	pr. of 1000 yds.
		3	
£. 3337	10	0	pr. of 3000 yds.

2. What will 4000 yards come to, at 3 shillings and 3 pence 1 farthing per yard?

£.	s.	d.	
0	3	3¼	
		10	
1	12	8½	price of 10 yds.
		10	
16	7	1	price of 100 yds.
		10	
163	10	10	pr. of 1000 yds.
		4	
£. 654	3	4	pr. of 4000 yds.

QUESTIONS.	yds. pounds, &c.		£.	s.	d.		ANSWERS. £.	s.	d.
3.	5000	at	0	17	4	per yd.	4333	6	8.
4.	6000	at	1	6	8		8000	0	0.

CASE. VI. When the quantity is any number of hundreds, or thousands over twelve, which are expressed by numbers in the multiplication table, find the price of one hundred, or thousand, by the foregoing Cases; then multiply the price of one hundred, or thousand, by two such numbers, as, when multiplied together, will express the hundreds, or thousands, in the question.

EXAMPLES.

1. What will 1800 yards come to, at 3 shillings and 2 pence per yard?

2. What will 24000 yards come to, at 4 shillings and 5 pence 1 farthing per yard?

£.	s.	d.	
0	3	2	
		10	
1	11	8	price of 10 yds.
		10	
15	16	8	price of 100 yds.
		6	
95	0	0	price of 600 yds.
		3	
£.285	0	0	price of 1800 yds.

£.	s.	d.	
0	4	5½	
		10	
2	4	4½	price of 10 yds.
		10	
22	3	9	price of 100 yds.
		10	
221	17	6	price of 1000 yds.
		6	
1331	5	0	price of 6000 yds.
		4	
£.5325	0	0	price of 24000yds.

QUESTIONS. ANSWERS.

	yds. pounds, &c.		£.	s.	d.		£.	s.	d.
3.	36000	at	0	15	7	per yd.	28050	0	0.
4.	4200	at	0	16	8		3500	0	0.

CASE VII. When the quantity is hundreds, or thousands, which are not expressed by numbers in the multiplication table, find the price of the whole quantity as near as you can by Case VI. then add or subtract the price of the odd hundreds, or thousands, as the case may require.

EXAMPLES.

1. What will 1900 yards come to, at two shillings and 6 pence per yard?

£.	s.	d.	
0	2	6	
		10	
1	5	0	pr. of 10 yds.
		10	
12	10	0	pr. of 100 yds.
		6	
75	0	0	pr. of 600 yds.
		3	
225	0	0	pr. of 1800 yds.
add 12	10	0	pr. of 100 yds.
£.237	10	0	pr. of 1900 yds.

2. What will 23000 yards come to, at 1 shilling and 4 pence 3 farthings per yard?

£.	s.	d.	
0	1	4¾	
		10	
0	13	11½	pr. of 10 yds.
		10	
6	19	7	pr. of 100 yds.
		10	
69	15	10	pr. of 1000 yds.
		6	
418	15	0	pr. of 6000 yds.
		4	
1675	0	0	pr. of 24000 yds.
subtr. 69	15	10	pr. of 1000 yds.
£.1605	4	2	pr. of 23000 yds.

Questions.	yards, pounds, &c.		£.	s.	d.		Answers. £.	s.	d.
3.	85000	at	0	12	8	per yd.	52062	10	0.
4.	1760	at	0	6	8		566	13	4.

Case VIII. When the quantity consists of units, tens, hundreds, thousands, &c. find the price of the thousands, hundreds, &c. separately; then add the price of the several parts together; the sum will be the price of the whole quantity.

Examples.

1. To what will 48448 yards amount, at two shillings and 6 pence per yard?

£.	s.	d.	
0	2	6	price of 1 yd.
		10	
1	5	0	price of 10 yds.
		10	
12	10	0	price of 100 yds.
		10	
125	0	0	price of 1000 yds.
		8	
1000	0	0	pr. of 8000 yds.
		6	
6000	0	0	price of 48000 yds.
50	0	0	price of 400 yds.
6	0	0	price of 48 yds.
£.6056	0	0	price of 48448 yards. Answer.

£.	s.	d.	
12	10	0	pr. of 100 yds.
		4	
£.50	0	0	pr. of 400 yds.
0	2	6	pr. of 1 yd.
		8	
1	0	0	pr. of 8 yds.
		6	
£.6	0	0	pr. of 48 yds.

Questions.	yards, pounds, &c.		£.	s.	d.		Answers. £.	s.	d.
2.	96369	at	0	13	4	per yd.	64246	0	0.
3.	32840	at	0	2	6		4105	0	0.
4.	153½	at	1	3	4½		179	8	0¾.
5.	1277¾	at	0	4	6		287	9	10½.

Case IX. To find the price of an *hundred (gross)* or 112 pounds, having the price of one pound given.

Rule. Multiply the price of one pound by 7, its product by 4, and this product again by 4; the last product will be the answer.

EXAMPLES.

1. What will 1 cwt. of lead come to, at $6\frac{1}{2}$d. per pound?

£.	s.	d.	
0	0	$6\frac{1}{2}$	price of 1 lb.
		7	
0	3	$9\frac{1}{2}$	price of 7 lb.
		4	
0	15	2	price of 28lb. or $\frac{1}{4}$ cwt.
		4	
£. 3	0	8	price of 1 cwt.

2. 1 cwt of sugar, at 10d. per pound? £.4 13 4 Ans.
3. 1 cwt. of tobacco, at 1s. 2d. per pound? £.6 10 8 Ans.

CASE X. Having the price of one pound given, to find the price of two or more cwts.

RULE. Find the price of 1 cwt. by Case IX. then multiply the price of 1cwt. by so many as there are cwts. in the question.

Note. If the quantity exceed twelve cwt. having found the price of 1 cwt. proceed as in Case II. or III.

QUESTIONS.		ANSWERS.
1.	5 cwt. of cheese, at $6\frac{1}{2}$d. per pound?	£.15 3 4.
2.	8 cwt. of tobacco, at 10d. per pound?	£.37 6 8.
3.	25 cwt. of cotton, at 1s. 2d. per pound?	£.163 6 8.

COMPOUND DIVISION.

Compound Division is, when the dividend consists of several denominations.

RULE. Separate the divisor from the dividend as in simple division; then proceed to divide, beginning with the highest denomination, and having divided *that*, if there be a remainder, reduce it to the next lower denomination, and add in that which is of the same name; then divide as before. Thus continue to reduce and divide till every denomination is divided.

CASE I. When the shares are equal, divide by the number of partners; the quotient will be each one's particular share.*

* All the questions in the first and second cases of compound division may be proved by compound Multiplication.

EXAMPLES.

1. If £.24 9 9 be divided equally among 18 men, what will each have?

£. s. d. £. s. d.
18)24 9 9 (1 7 2¼ Answer.
18
—
6
20
—
18)129(7
126
—
3
12
—
18)45(2
36
—
9
4
—
18)36(2
36
—

In this example, I find that the divisor is contained but once in the highest denomination, which is pounds; I then subtract the divisor 18 from 24 pounds, and find that 6 remains, which I multiply by 20, and add in the 9 shillings; I thus proceed till every denomination is divided.

2. If £.17 10 8¼ be divided equally among 15 persons, what will each have? £.1 3 4¼ Ans.

3. If £.165 be divided equally among 99 persons, what will each have? £.1 13 4 Answer.

4. If £.9 12 10 be divided equally among 26 persons, what will each have? 7s. 5d. Answer.

5. Twenty-four persons have a frolic; and after they have broke up, they find their reckoning amounts to £.10 5 6; what must each pay? 8s. 6¼ d. Ans.

Note. When the divisor does not exceed 12, proceed as directed in short division; only with this difference, that when there is a remainder, after dividing *one* denomination, you must reduce it, mentally, to the *next lower* denomination, and add to it that part of the dividend which is of the same name; then proceed to divide, and set each figure of the quotient directly under those of the same denomination.

EXAMPLES.

1. If 4 pounds be divided equally among 3 persons, what will each have?

£. s. d.
3)4 0 0
£.1 6 8 Answer.

2. Divide 7 pounds, 11 shillings, and 5 pence half penny equally among 5 persons.

£. s. d.
5)7 11 5½
1 10 3½ Answer.

3. Divide 12 pounds, 2 shillings, and 2 pence 3 farthings equally among 7 persons.

£.	s.	d.
7)12	2	2¾
£. 1	14	7¼

4. Divide 72 pounds, 5 shillings equally among 10 persons.

£.	s.	d.
10)72	5	0
£.7	4	6 Ans.

5. If £. 4 10 3 be divided equally among twelve men, what will each have? 7s. 6¼d. Answer.

6. If £.13 0 3 be divided equally among six men, what will each have? £. 2 3 4¼ Answer.

7. A gentleman dying, left £.963 18 to be divided in the following manner, viz. To the widow he gave one third part, and the remainder was to be divided equally among 6 children; what was each one's portion?

£.321 6 widow's portion,
107 2 each child's portion, } Answer.

CASE II. Having the price of any number or quantity given, to find the price of *one* yard, pound, &c.

RULE. Divide the price of the whole number or quantity by the number or quantity; the quotient will be the price of one yard, pound, &c.

EXAMPLES.

1. If I give 678 15 for 600 yards of cloth; what is the price of one yard?

£.	s.	£.	s.	d.
600)678	15(1	2	7½ Answer.	
600				
78				
20				
600)1575(2				
1200				
375				
12				
600)4500(7				
4200				
300				
4				
600)1200(2				
1200				

2. If 1100 yards cost £.201 1S 4; what is it per yard? 3s. 8d Answer.

3. If 900 yards cost £.53 8 9; what is it per yard? 1s. 2¼d. Answer.

4. If 145 pounds of cotton cost £.18 2 6; what is the price of 1 pound? 2s. 6d. Answer.

CASE III. When the shares are unequal, divide the sum by the number of simple shares; the quotient will be the first one's share; then multiply the first one's share by so many as the second has shares more than the first; the product will be the second's share. Thus proceed for every succeeding share.

PROOF. Add all the shares into one sum; if it be equal to the dividend, the work is right.

EXAMPLES.

1. Divide £.112 1 among A, B, and C; give B twice as much as A, and C three times as much as B; what will each have?

A has 1 simple share.
B — 2 simple shares.
C — 6 simple shares.

9 number of simple shares.

£.	s.		£.	s.	
9)112	1	(	12	9	A's share.
9				2	
22			£.24	18	B's share.
18				3	
4			£.74	14	C's share.
20					
			£.112	1	Proof.
9)81(9					
81					

2. If you divide £.364 between A and B, and give B twice as much as A, what will each have?

£.121 6 8 A's share,
242 13 4 B's share, } Answer.

3. Divide £.326 16 among A, B, C, and D; give B three times as much as A, C four times as much as B, and D five times as much as C; what will each have?

£. 4 6 A's share.
12 18 B's share.
51 12 C's share.
258 0 D's share. } Answer.

4. Divide £.3838 3 6 among A, B, C, and D; give B four times as much as A, C three times as much as B, and D ten times as much as all the others; what will each have?

£.	20	10	6	A's share.
	82	2	0	B's share.
	246	6	0	C's share.
	3489	5	0	D's share.

Answer.

5. A gentleman dying, left £.666 18, of which his widow was to have one third part, and the remainder was to be divided among seven children, in such manner as to give the eldest a double portion: what did each have?

£.	222	6	0	widow's portion.
	55	11	6	single portion.
	111	8	0	double portion.

Answer.

6. Divide £.389 8 6 among A, B, and C; give B ten times as much as A, and C ten times as much as B; what will each have?

£.	3	10	2	A's share.
	35	1	8	B's share.
	350	16	8	C's share.

Answer.

7. Divide £.196 15 9 among 3 men, 3 women, and 3 boys; give each man double to each woman, and each woman double to each boy; what will each have?

£.	9	7	5	one boy's share.
	18	14	10	one woman's share.
	37	9	8	one man's share.

Answer.

Division of Federal Money.

Case I. When the dividend is dollars only.

Rule. Proceed as in simple division, and if there be a remainder, make a comma at the right hand of the quotient, then annex two cyphers to the remainder, and divide as before, and set the quotient at the right hand of the comma, which will be cents; then, if there be still a remainder, make a comma at the right hand of the cents, and annex one cypher to the remainder, and divide as before; the quotient will be mills.*

* To prove questions in this, and the following cases, multiply the quotient by the divisor, and add in the last remainder; then point off the figures of the product, as directed in Multiplication of Federal Money.

EXAMPLES.

1

dol. dol. cts.

28)9758(348, 50

84

135

112

238

224

1400

140

0

2

dol. dol. cts. m.

18)7568(420, 44, 4

72

36

36

800

72

80

72

80

72

8

3. If three thousand, five hundred and eight dollars be divided equally among forty-five men; what will each have?

dol. 77, 95, 5 Ans.

4. If 630 dollars be divided equally among 14 men, what will each have? 45 dol. Answer.

5. If 785 dollars be divided equally among 17 men, what will each have? dol. 46 17 6 Answer.

Case II. When the dividend is dollars and cents.

Rule Proceed as in simple division till every figure of the dividend is brought down; then point off the two right hand figures of the quotient for cents; and if there be a remainder, make a comma at the right hand of the cents, and annex a cypher to the remainder; then divide, and place the quotient figure, which is mills, at the right hand of the comma.

EXAMPLES.

1

dol. cts. dol. cts. m.

56)783, 75(13, 99, 5

56

223

168

557

504

535

504

310

280

30

2

dol. cts. dol. cts. m.

36)425, 25(11, 81 2

36

65

36

292

288

45

36

90

72

18

Note. When the divisor is greater than the number of dollars in the dividend, the quotient will be cents only, or cents and mills.

3				4		
dol.	cts.	cts.	m.	dol.	cts.	cts.
25)18,	83	(75,	3	15)10,	50	(70
175				105		
133				0		
125						
80						
75						
5						

5. Divide 542 dollars, 33 cents equally among 12 men; what will each have? dol. 45, 19, 4 Answer.

6. Divide 89 dollars, 5 cents equally among 9 men; what will each have? dol. 9, 89, 4 Answer.

7. Divide 12 dollars, 66 cents, equally among 16 men; what will each have? cents 79, 1 Answer.

Case III. When the dividend is cents and mills, or dollars, cents, and mills.

Rule. Proceed as in simple division, till every figure of the dividend is brought down and divided; then point off the first right hand figure of the quotient for mills, the two next for cents; what then remains on the left hand are dollars.

EXAMPLES.

1							2						
dol.	cts.	m.	dol.	cts.	m.		dol.	cts.	m.	dol.	cts.	m.	
75)431,	60,	7	(5,	75,	4		65)108,	98,	5	(1,	66,	2.	
375							65						
566							430						
525							390						
410							408						
375							390						
357							185						
300							130						
57							55						

3. If two hundred and ninety-five dollars, twenty cents, five mills be divided equally among thirteen men, what will each have? dols. 22, 70, 8 Answer.

4. If one hundred and two dollars, eight cents, six mills be divided equally among nine men, what will each have?
dol. 11, 34, 3 Answer.

5. If 45 yards of cloth cost 38 dollars, 97 cents, 5 mills; what is the price of one yard? cents 75, 5 Answer.

6. If 183 yards cost 37 dollars, 88 cents, 1 mill, what is the price of 1 yard? cents 20, 7 Answer.

7. If 15 yards cost 108 dollars, 79 cents, 5 mills, what is the price of one yard? dol. 7, 25, 3 Answer.

Practical Questions in Federal Money.

1. Divide 408 dollars among A, B, and C; give B three times as much as A, and C four times as much as B; what will each have?

dols. 25, 50 A's share.
76, 50 B's share.
306, 00 C's share.
} Answer.

2. A gentleman divided 2586 dollars among two sons and a daughter, in the following manner, viz. to the first son he gave one half; to the second, one third; and the rest to the daughter; what did each have?

dol. 1293 first son's share.
862 second's share.
431 daughter's share.
} Answer.

3. Suppose I give 2775 dollars for 150 acres of land; what do I give per acre? dol. 18, 50 Answer.

4. Divide 16329 dollars, 25 cents among A, B, C, and D; give B twelve times as much as A, C ten times as much as B, and D ten times as much as C; what will each have?

dol. 12, 25 A's share.
147, 00 B's share.
1470, 00 C's share.
14700, 00 D's share.
} Answer.

5. Divide 462 dollars in such manner as to give A an eighth part, and B the rest; what will each have?

dol. 57, 75 A's share.
404, 25 B's share.
} Answer.

Application *of the foregoing* Rules.

Questions.*

1. Write in figures the following numbers, viz. One hundred and two million, three hundred and four thousand, five hundred and six.

2. A, B, and C bought a quantity of goods, for which A paid 145 dollars, B 508 dollars, and C 1056 dollars; what did the goods cost? 1709 dol. Answer.

* In these questions the work at large is omitted, with a view to exercise the learner.

3. A gentleman has four farms. The first is valued at £.3518 15 8, the second at £.295 13, the third at £.158 14 7½, the fourth at £.72 3 6; what are they all worth?

£.4045 6 9½ Answer.

4. A man bought three horses; for the first he gave 147 dollars, 75 cents; for the second, 97 dollars, 50 cents; and for the third 80 dollars, 25 cents; what did the horses cost him? dol. 325,50 Answer.

5. How many must be added to 95 in order to make the sum 149? 54 Answer.

6. How many must be taken from 149, in order to have the remainder 54? 95 Answer.

7. What is the difference between one hundred and one, and two thousand and two? 1901 Answer.

8. Suppose a man born in the year 1713; how old will he be in the year 1797? 84 Answer.

9. A challenged B to swap horses. A valued his horse at 108 dollars, B valued his at 136 dollars, but A being unwilling to pay the difference, they agreed to *split* the difference: how much boot-money did B receive? 14 dol. Answer.

10. What is the product of 184 and 75? 13800 Answer.

11. Suppose a corn-field contain 985 rows, and each row produce fifteen bushels; how many bushels will the whole field produce? 5775 bushels Answer.

12. To what will the corn in the last question amount, at 6s. 8d. per bushel? £.1925 Answer.

13. Said Harry to Tom, if you divide the number of my apples by 9, the quotient will be 15; now if you understand figures well enough to tell how many apples I have, you shall have a third part of them: What number of apples had Harry, and how many did he give Tom?

135 number of Harry's apples.
45 he gave Tom. } Answer.

14. How many ½d. and farthings are there in £.15 10 7?

7454 half pence.
14908 farthings. } Answer.

15. Said A to B, how old are you? 19 years, answered B; and how old are you? To which A replied, the sum of both our ages is 55; now said A, if you will tell my age in two minutes, I will give you as many farthings as I am years old; how old was A, and how much money did he offer B?

36 A's age.
9 pence. } Answer.

16. If 1176 dollars be divided among *so many*, that each man's share is 14 dollars, how many partners are there?

84 Answer.

17. Divide 87 dollars, 50 cents, among A, B, C, D, and E; give B one dollar more than A, C one dollar more than B, &c. what will each have?

dols. 15, 50 A's share.
16, 50 B's share.
17, 50 C's share.
18, 50 D's share.
19, 50 E's share.
} Answer.

18. A gentleman had two sons and a daughter, to whom he gave the following sums, viz. To the first son he gave £.218 16 8; to the second, £.139 17 6; and to the daughter, a sum, which, if added to the second son's, would make a sum equal to the first son's; what was his daughter's portion

£. 78 19 2 Answer.

19. What number is that, which if multiplied by 18, and the product divided by 9, will leave 50 in the quotient?

25 Answer.

20. What is the difference between six and eight pence, and eight and six pence? 1s. 1od. Answer.

21. The product of A's and B's ages is 1800; A's age is 75 years; what is B's age? 24 years Answer.

VULGAR FRACTIONS.

FRACTIONS are parts of an unit, or whole number; and are expressed by two numbers, one being placed over the other, and separated by a line thus, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{5}$, $\frac{9}{10}$, signifying one third, one fourth, three fifths, nine tenths, &c.

The number above the line is called the *numerator*;* that under the line is called the *denominator*.

The denominator shews the number of parts into which the integer is divided; and the numerator shews how many of those parts are taken.

Fractions are of four kinds, viz. *proper*, *improper*, *compound* and *mixed*.

1. A *proper fraction* is when the numerator is less than the denominator; thus, $\frac{2}{3}$ $\frac{7}{8}$ $\frac{1}{5}$ $\frac{9}{18}$ $\frac{11}{19}$, &c.

2. An *improper fraction* is when the denominator is less than the numerator; thus, $\frac{4}{2}$ $\frac{8}{3}$ $\frac{12}{8}$ $\frac{18}{4}$, &c.

* The *remainder*, after dividing any number, is the *numerator*, and the *divisor* is the *denominator*: which fraction, when reduced *to its lowest terms*, should always be annexed to the quotient.

3. A *compound fraction* is the fraction of a fraction, and is thus expressed, $\frac{1}{3}$ of $\frac{1}{4}$; $\frac{1}{8}$ of $\frac{5}{6}$ of $\frac{3}{4}$; and is thus read, one third of three fourths; one eighth of five sixths of three fourths.

4. A *mixed number* is a whole number with a fraction annexed, thus, $8\frac{1}{4}$, $12\frac{1}{2}$, $9\frac{5}{7}$; that is, eight and three fourths, twelve and an half, &c.

Note. Any whole number may be made an improper fraction, by drawing a line under it, and making 1 the denominator: thus, 8, 11, 18, 24, may be expressed $\frac{8}{1}$ $\frac{11}{1}$ $\frac{18}{1}$ $\frac{24}{1}$, which are improper fractions.

A fraction, when it is expressed by the least numbers possible, is in its lowest terms; thus $\frac{72}{144}$, $\frac{53}{159}$, when reduced to their lowest terms, are $\frac{1}{2}$, $\frac{1}{3}$.

Reduction of Vulgar Fractions.

CASE I. To reduce fractions to their lowest terms.

RULE. Divide both the numerator and denominator by any number which will divide them without a remainder; the quotient of each again by the same or another number, which will do likewise; thus continue to divide till no number greater than 1 will divide them without a remainder; the fraction will then be in its lowest terms.

EXAMPLES.

1. Reduce $\frac{108}{144}$ to its lowest terms.

$$\frac{108}{144} \;\Big|\; \frac{54}{72} \;\Big|\; \frac{9}{12} \;\Big|\; \frac{3}{4} \text{ Answer.}$$

2 6 3

In this example, I first divide the numerator and denominator by 2; their quotients by 6; these quotients again by 3, which brings the fraction to its lowest terms.

Note. A fraction may be brought to its lowest terms, thus, divide the denominator by the numerator, and if there be a remainder divide the numerator by it; thus continue to divide the last divisor by the last remainder till nothing remain; then divide both the numerator and denominator of the given fraction *by this last divisor*; their quotients will shew the given fraction *in its lowest terms.*

For example take the first.

108)144(1
108

36)108(3
108

Then, $36)\frac{108}{144}(\frac{3}{4}$ Answer.

2. Reduce $\frac{90}{180}$ to its lowest terms. $\frac{1}{2}$ Ans.
3. Reduce $\frac{200}{600}$ to its lowest terms. $\frac{1}{3}$ Ans.
4. Reduce $\frac{27}{45}$ to its lowest terms. $\frac{3}{5}$ Ans.
5. Reduce $\frac{176}{1792}$ to its lowest terms. $\frac{11}{112}$ Ans.
6. Reduce $\frac{25}{200}$ to its lowest terms. $\frac{1}{8}$ Ans.
7. Reduce $\frac{126}{180}$ to its lowest terms. $\frac{9}{10}$ Ans.
8. Reduce $\frac{1320}{2464}$ to its lowest terms. $\frac{3}{7}$ Ans.

CASE II. To reduce a mixed number to an improper fraction.

RULE. Multiply the integer by the denominator of the fraction, and to the product add the numerator; then draw a line and place the denominator under it.

EXAMPLES.

1. Reduce $8\frac{3}{5}$ to an improper fraction.

$8\frac{3}{5}$
5
43

$\frac{43}{5}$ Ans.

2. Reduce $15\frac{1}{4}$ to an improper fraction. $\frac{61}{4}$ Ans.
3. Reduce $12\frac{1}{2}$ to an improper fraction. $\frac{25}{2}$ Ans.
4. Reduce $25\frac{3}{4}$ to an improper fraction. $\frac{103}{4}$ Ans.

CASE III. To reduce an improper fraction to a whole or mixed number.

RULE. Divide the numerator by the denominator; the remainder will be the numerator, and the divisor the denominator to the fractional part.

EXAMPLES.

1. Reduce $\frac{43}{5}$ to a whole, or mixed number.

5)43($8\frac{3}{5}$ Answer.
40

3

2. Reduce $\frac{61}{4}$ to a whole, or mixed number.

$15\frac{1}{4}$ Answer.

3. Reduce $\frac{103}{4}$ to a whole, or mixed number.

$25\frac{3}{4}$ Ans.

CASE IV. To reduce a compound fraction to a simple one.

RULE. Multiply all the numerators into each other for a new numerator, and all the denominators for a denominator.

Note. If part of a compound fraction be composed of a whole, or mixed number, it must be reduced to an improper fraction.

EXAMPLES.

1. Reduce $\frac{3}{4}$ of $\frac{1}{5}$ of $\frac{4}{5}$ to a simple fraction.

In this example, I say, 3 times 1 are 3, and 3 times 4 are 12, which is the new numerator; then 4 times 3 are 12, and 12 times 5 are 60, which is the new denominator; therefore the compound fraction, when reduced to a simple one, is, in its highest terms, $\frac{12}{60}$; but when reduced to its lowest terms, it is $\frac{1}{5}$.

2. Reduce $\frac{1}{2}$ of $\frac{1}{3}$ of 8 to a simple fraction.

$\frac{8}{6}$ Ans. and $\frac{8}{6}$ is $1\frac{1}{3}$.

3. Reduce $\frac{1}{9}$ of $\frac{7}{8}$ of $\frac{3}{5}$ to a simple fraction.

$\frac{21}{360}$ Ans. and $\frac{21}{360}$ is $\frac{7}{120}$.

4. Reduce $\frac{5}{8}$ of $\frac{3}{4}$ of $7\frac{1}{3}$ to a simple fraction.

$\frac{330}{96}$ Ans. and $\frac{330}{96}$ is $3\frac{7}{16}$.

5. Reduce $\frac{11}{12}$ of $\frac{9}{10}$ of $\frac{4}{5}$ of 7 to a simple fraction.

$\frac{2772}{600}$ Ans. and $\frac{2772}{600}$ is $4\frac{31}{50}$.

6. Reduce $\frac{1}{8}$ of $\frac{1}{4}$ to a simple fraction. $\frac{3}{32}$ Ans.

CASE V. To reduce fractions of different denominators to equivalent fractions, having a common denominator.

RULE. Multiply the numerator of each fraction into all the denominators except its own, the product will be a new numerator for that fraction; thus proceed till you get a new numerator for each fraction. Then multiply all the denominators into each other; the product will be a common denominator, which being placed under *each numerator* will form the fractions required.

EXAMPLES.

1. Reduce $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{2}{5}$ to a common denominator.

In this example, once 4 are 4, and 4 times 5 are 20, which is the new numerator for $\frac{1}{3}$; then, 3 times 3 are 9 and 9 times 5 are 45, the numerator for $\frac{1}{4}$; again, 2 times 4 are 8 and 8 times 3 are 24, the numerator for $\frac{2}{5}$; then 3 times 4 are 12 and 12 times 5 are 60, which is a common denominator to each new numerator, and being placed under them respectively, the fractions will stand thus, $\frac{20}{60}$, $\frac{45}{60}$, $\frac{24}{60}$.

2. Reduce $\frac{3}{8}$, $\frac{5}{6}$, $\frac{2}{3}$, and $\frac{9}{10}$ to a common denominator.
$\frac{540}{1440}$, $\frac{1200}{1440}$, $\frac{960}{1440}$, $\frac{1296}{1440}$. Answer.

3. Reduce $\frac{3}{4}$, $\frac{1}{2}$ and $\frac{11}{13}$ to a common denominator.
$\frac{78}{104}$, $\frac{52}{104}$, $\frac{88}{104}$ Answer.

4. Reduce $\frac{4}{7}$ of $\frac{2}{3}$, $5\frac{1}{4}$ and $\frac{7}{8}$ to a common denominator. $\frac{288}{756}$, $\frac{3969}{756}$, $\frac{588}{756}$ Answer.

5. Reduce $\frac{8}{11}$, $\frac{7}{8}$ and $\frac{1}{5}$ of 6 to a common denominator. $\frac{320}{440}$, $\frac{385}{440}$, $\frac{528}{440}$ Answer.

CASE VI. To find the true value of any fraction, whether of coin, weight, or measure.

RULE. Multiply the integer by the numerator, and divide the product by the denominator; then if there be a remainder reduce it to the next lower denomination, and divide as before; thus proceed with every succeeding remainder till it is reduced to the lowest denomination.

EXAMPLES.

1. What is the value of $\frac{2}{3}$ of a pound, or 20 shillings?

s.
20
2
— s. d.
3)40(13 4 Answer.
3
10
9
1
12
3)12(4
12

2. What is the value of $\frac{3}{8}$ of a pound?

s.
20
3
— s. d.
8)60(7 6 Answer.
56
4
12
8)48(6
48

3. What is the value $\frac{7}{9}$ of a pound?
15s. 6d. $2\frac{2}{3}$q. Ans.
4. What is the value of $\frac{3}{8}$ of a dollar? 60 cts. Ans.
5. What is the value of $\frac{4}{5}$ of a lb. Troy?
9 oz 12 pwt. Ans.
6. What is the value of $\frac{2}{3}$ of a lb. Avoirdupois?
10 oz. $10\frac{2}{3}$ dr. Ans.
7. What is the value of $\frac{3}{4}$ of 1 cwt.? 84lb. Ans.
8. What is the value of $\frac{11}{13}$ of a pound?
16s. $11\frac{1}{13}$d.

CASE VII. To reduce the fraction of a low denomination to the fraction of a high denomination.

RULE. Reduce the integer of *that* denomination of which the fraction is *required*, to *that* of which the given fraction is a part; then multiply by the denominator of the given fraction, and over the product place the numerator, and it will form the fraction required.

EXAMPLES.

1. Reduce $\frac{3}{4}$ of a penny to the fraction of a pound.

s.
20
12
240
4
960

$\frac{3}{960}$ Ans. and $\frac{3}{960}$ is $\frac{1}{320}$.

2. Reduce $\frac{1}{2}$ of a penny to the fraction of a pound.
$\frac{1}{480}$ Answer.
3. Reduce $\frac{2}{3}$ of a farthing to the fraction of a shilling.
$\frac{2}{144}$ Ans. and $\frac{2}{144}$ is $\frac{1}{72}$.
4. Reduce $\frac{3}{5}$ of an inch to the fraction of a yard.
$\frac{3}{180}$ Ans. and $\frac{3}{180}$ is $\frac{1}{60}$.
5. Reduce $\frac{5}{8}$ of a foot to the fraction of a mile
$\frac{5}{42240}$ is $\frac{1}{8448}$ Ans.
6. Reduce $\frac{1}{3}$ of a cent to the fraction of a dollar.
$\frac{1}{300}$ Ans.
7. Reduce $\frac{11}{12}$ of an ounce to the fraction of a pound Troy.
$\frac{11}{144}$ Ans.

8. Reduce $\frac{3}{7}$ of a dram to the fraction of a pound Avoirdupois. $\frac{3}{7792}$ Ans.

9. Reduce $\frac{5}{8}$ of a pound Avoirdupois to the fraction of 1 cwt. $\frac{5}{1008}$ Ans.

CASE VIII. To reduce the fraction of a high denomination to the fraction of a low denomination.

RULE. Reduce the integer of *that* denomination of which the given fraction is a part, to *that* of which the fraction is *required*; then, multiply by the numerator of the given fraction, and under the product place the denominator, and it will form a fraction, which when reduced to its lowest terms will be the answer.

EXAMPLES.

1. Reduce $\frac{1}{320}$ of a pound to the fraction of a penny.

s.
20
12

240

$\frac{240}{320}$ and $\frac{240}{120}$ is $\frac{2}{4}$d. Answer.

Note. This case is the reverse of Case VII. and therefore proves it.

2. Reduce $\frac{1}{480}$ of a pound to the fraction of a penny. $\frac{1}{2}$d. Answer.

3. Reduce $\frac{1}{72}$ of a shilling to the fraction of a farthing. $\frac{3}{4}$q. Answer.

4. Reduce $\frac{1}{60}$ of a yard to the fraction of an inch. $\frac{3}{5}$ Answer.

5. Reduce $\frac{1}{8448}$ of a mile to the fraction of a foot. $\frac{5}{8}$ Answer.

6. Reduce $\frac{1}{300}$ of a dollar to the fraction of a cent. $\frac{1}{3}$ Answer.

7. Reduce $\frac{11}{144}$ of a pound Troy to the fraction of an ounce. $\frac{11}{12}$ Answer.

8. Reduce $\frac{3}{7792}$ of a pound Avoirdupois to the fraction of a dram. $\frac{3}{7}$ Answer.

9. Reduce $\frac{5}{1008}$ of 1 cwt. to the fraction of a pound Avoirdupois. $\frac{5}{8}$ Answer.

Addition of Vulgar Fractions.

RULE. Mixed numbers must be reduced to improper *fractions*; *compound* fractions to simple ones; fractions

of different denominations to those of the same; then reduce the fractions to a common denominator, and add all the numerators together for a numerator, under which set the common denominator, and it will form a fraction, which when reduced to its lowest terms will be the answer.

EXAMPLES.

1. Add $\frac{1}{5}$, $\frac{2}{5}$, and $\frac{3}{8}$ together.

In this example, I reduce the fractions to a common denominator, by Case V. thus, once 5 are 5, and 5 times 8 are 40, which is the numerator for $\frac{1}{5}$; then, 2 times 3 are 6, and 6 times 8 are 48, the numerator for $\frac{2}{5}$; again, 3 times 3 are 9, and 9 times 5 are 45, the numerator for $\frac{3}{8}$; then, 3 times 5 are 15, and 15 times 8 are 120, which is the common denominator; then write the common denominator under each new numerator, and the fractions appear thus, $\frac{40}{120}$, $\frac{48}{120}$, $\frac{45}{120}$: then, add all the numerators into one sum, under which, place the common denominator, and the fraction required, in its highest terms, stands thus, $\frac{133}{120}$, which is an improper fraction, but, being reduced to a whole, or mixed number, it appears thus, $1\frac{13}{120}$, the answer required.

2. Add $\frac{3}{5}$, $\frac{1}{9}$, $\frac{7}{11}$, and $\frac{1}{8}$ together. $1\frac{187}{3960}$ Ans.

3. Add $7\frac{4}{5}$, $\frac{5}{7}$ of $\frac{3}{8}$, and 7 together. $15\frac{19}{280}$ Ans.

4. Add $\frac{1}{5}$ of a pound, $\frac{3}{7}$ of a shilling, and $\frac{4}{5}$ of a penny together. 2s. $8\frac{64}{105}$d. Ans.

5. Add $\frac{3}{7}$ of $\frac{1}{15}$, and $\frac{1}{5}$ of $4\frac{1}{2}$ together. $\frac{57}{70}$ Ans.

6. Add $\frac{1}{8}$ of a dollar, $\frac{3}{5}$ of a cent, and $\frac{7}{9}$ of a mill together. cents 13, $2\frac{4}{5}$ Ans.

Subtraction of Vulgar Fractions.

RULE. Reduce the fractions to a common denominator, as in addition; then subtract one numerator from the other, and set the difference over the common denominator; the fraction, when reduced to its lowest terms, will be the answer.

EXAMPLES.

1. From $\frac{3}{4}$ take $\frac{1}{3}$.

In this example, I reduce the fractions to a common denominator; which, being done, the fractions stand

thus, $\frac{9}{12}$, $\frac{4}{12}$; then, the difference of the numerators, which is 5, being placed over the common denominator, the fraction stands thus, $\frac{5}{12}$, which is the answer required.

2. From $\frac{5}{8}$ take $\frac{1}{9}$ of $\frac{8}{11}$. $\frac{479}{792}$ Answer.
3. From $\frac{3}{7}$ of a pound take $\frac{3}{4}$ of a shilling. 12/7 Ans.
4. From $4\frac{1}{2}$ take $1\frac{4}{5}$. $2\frac{7}{10}$ Ans.
5. From $\frac{10}{11}$ of a lb. Troy take $\frac{3}{4}$ of a pwt.
10 oz. 17 pwt. $10\frac{4}{11}$ gr. Ans.
6. From $\frac{23}{32}$ take $\frac{3}{5}$ of $\frac{1}{8}$. $\frac{103}{160}$ Ans.
7. From $\frac{1}{3}$ of $2\frac{1}{2}$ take $\frac{3}{6}$ of $1\frac{3}{5}$. $\frac{61}{90}$ Ans.

Note. A simple fraction may be subtracted from a whole number thus; subtract the numerator of the fraction from the denominator; and place the difference over the denominator; then take 1 from the whole number.

EXAMPLES.

	1.	2.	3.
From	8	12	17
Take	$\frac{3}{4}$	$\frac{4}{5}$	$\frac{11}{13}$
Ans.	$7\frac{1}{4}$	$11\frac{1}{5}$	$16\frac{2}{13}$

4. From 24 dollars take $\frac{4}{5}$ of a dollar.
dol. $23\frac{1}{5}$; *or* 23, 20 Ans.
5. From 14 pounds take $\frac{3}{4}$ of a pound.
£. $13\frac{1}{4}$; *or* 13 6 8 Ans.

Multiplication of Vulgar Fractions.

RULE. Having reduced mixed numbers to improper fractions, and compound fractions to simple ones, multiply all the numerators into each other for the numerator, and all the denominators into each other for the denominator, of the fraction required; which fraction, being reduced to its lowest terms, is the answer.

EXAMPLES.

1. Multiply $\frac{11}{13}$ by $\frac{18}{49}$.

18	49
11	13
18	147
18	49
198 numerator.	637 denominator.

Then, $\frac{198}{637}$ Answer.

2. Multiply $\frac{3}{8}$, $\frac{7}{9}$, $\frac{8}{11}$, and $\frac{3}{5}$ together. $\frac{7}{11}$ Ans.
3. What is the product of $\frac{4}{5}$, $\frac{9}{10}$, and $5\frac{1}{4}$? $2\frac{7}{8}$ Ans.
4. Multiply $\frac{14}{15}$ of $\frac{21}{25}$, by $\frac{4}{5}$ of $\frac{15}{14}$. $\frac{252}{425}$ Ans.
5. Multiply $8\frac{2}{4}$ by $\frac{1}{3}$ of $6\frac{1}{4}$. $18\frac{1}{16}$ Ans.

To multiply a whole number by a fraction.

RULE. Multiply the whole number by the numerator of the fraction, and divide *that* product by the denominator; the quotient will be the product required.

EXAMPLES.

	1.	2.	3.	4.
Multiply	12	8	13	72
by	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{2}{3}$	$\frac{7}{9}$
	4)36	5)24	3)26	9)504
Product	9	$4\frac{4}{5}$	$8\frac{2}{3}$	56

Note. When the numerator is 1, divide by the denominator only.

EXAMPLES.

	1.	2.	3.	4.
Multiply	16	19	28	75
by	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{2}{7}$	$\frac{1}{15}$
Product	4	$9\frac{1}{2}$	4	$6\frac{3}{15}$ is $6\frac{1}{5}$

To multiply a whole, by a mixed number.

RULE. Multiply by the fractional part, as before directed; then, multiply by the whole number; the sum of the products will be the product required.

EXAMPLES.

	1.	2.	3.
Multiply	15	24	45
by	$4\frac{2}{3}$	$8\frac{3}{5}$	$15\frac{3}{4}$
	3)30	5) 72	4)135
	10	$14\frac{2}{5}$	$33\frac{3}{4}$
	60	192	225
			45
Product	70	$206\frac{2}{5}$	$708\frac{3}{4}$

Division of Vulgar Fractions.

RULE. Having reduced compound fractions to simple ones, and mixed numbers to improper fractions, multiply the numerator of the divisor by the denominator of the dividend, the product will be the denominator of the quotient; then, multiply the denominator of the divisor by the numerator of the dividend, the product will be the numerator of the quotient, which being reduced to its lowest terms will be the answer; or, invert the divisor, and then proceed as in multiplication of vulgar fractions.

EXAMPLES.

1. Divide $4\frac{1}{4}$ by $\frac{4}{5}$.
   $4\frac{1}{4}$ is $\frac{19}{4}$; then, $\frac{4}{5})\frac{19}{4}(\frac{95}{16}$ quot. and $\frac{95}{16}$ is $5\frac{15}{16}$ Ans.
2. Divide $\frac{1}{8}$ of $\frac{2}{3}$ by $\frac{1}{8}$ of $\frac{1}{4}$. $\frac{8}{3}$ Ans.
3. Divide $\frac{1}{2}$ of 17 by $\frac{3}{4}$ of $\frac{2}{3}$. $11\frac{1}{3}$ Ans.
4. Divide $\frac{15}{16}$ by $\frac{3}{8}$. $1\frac{13}{32}$ Ans.
5. Divide $\frac{3}{8}$ by 7. $\frac{3}{56}$ Ans.
6. Divide $145\frac{2}{5}$ by $\frac{1}{3}$ of $\frac{6}{7}$. $508\frac{27}{30}$ Ans.

DECIMAL FRACTIONS.

DECIMAL fractions are wrought in the same manner as whole numbers, and are distinguished from whole numbers by a comma* placed at the left hand; thus, ,25 ,75 ,258 ,7853, which are read twenty-five hundredths, seventy-five hundredths, two hundred and fifty eight thousandths, &c.

The denominator of a decimal fraction is always understood, it being 1, with so many cyphers at the right hand as there are figures in the numerator, that is, if the numerator be one figure only, it is so many tenths as there are units in the figure; if the numerator consists of two places, it is so many hundredths; if three, so many thousandths, &c. Thus, ,2 ,25 ,258 if expressed in the manner of vulgar fractions would be $\frac{2}{10}$, $\frac{25}{100}$, $\frac{258}{1000}$, &c.

When there are more cyphers in the denominator, than there are places of figures in the numerator, the deficiency must be supplied by prefixing† a cypher, or cyphers, to the numerator; thus, $\frac{3}{100}$, $\frac{25}{1000}$, must be written, ,03, ,025, &c.

* The comma, in decimal fractions, or the point which separates a decimal fraction from a whole number, is called a Separatrix.

† *When cyphers are to be placed at the left hand* of any number, they are said to be prefixed *but when they are to be placed at the right hand*, they are said to be annexed.

To enumerate any decimal, begin at the left hand figure, and proceed to the right. The first figure at the left hand, or the figure next to the comma, is called tens; the second, hundreds; the third, thousands, &c.; each figure, from left to right, *decreasing* in the same proportion that whole numbers *increase* from right to left, as is shewn in the following

TABLE.

Tens, or tenth parts.	Hundreds, or hundredth parts.	Thousands, or thousandth parts.	Tens of thous. or ten thousandth parts.	Hund. of thous. or hun. thousandth parts.	Millions, or millionth parts.	Tens of Millions, or ten millionth parts.	Hund. of mill. or hund. millionth parts.
,5	8	6	7	4	8	3	5

NOTE. The first, second, third, fourth, &c. places of decimals, reckoning from the left hand to the right, are called primes, seconds, thirds, fourths, fifths, &c.

From the above Table, it appears plain, that every figure, counting from left to right, *decreases* in a tenfold proportion; that is, the value of a figure, in the place of *hundreds*, is ten times *less* than the value of the same figure in the place of *tens*; and the value of a figure, in the place of *thousands*, is ten times *less* than *that* of the same figure in the place of *hundreds*, &c. for an *hundredth* part is ten times *less* than a *tenth* part, and a *thousandth* part is ten times *less* than an *hundredth* part, &c.

The *annexing* of cyphers to a decimal fraction does neither *increase* nor *diminish* its value; for ,5, ,50 and ,500, that is, $\frac{5}{10}$, $\frac{50}{100}$, and $\frac{500}{1000}$, are all equivalent, being equal to $\frac{1}{2}$.

But, by *prefixing* cyphers to a decimal fraction, the value is *decreased*; for every cypher which is prefixed, renders the value of the fraction ten times *less* that it was before the cypher was prefixed; thus, ,5, ,05 and ,005 are of different values, as may be seen by expressing them in the manner of vulgar fractions; thus, ,5 is $\frac{5}{10}$; ,05 is $\frac{5}{100}$; ,005 is $\frac{5}{1000}$.

Addition of Decimals.

RULE. Whether the sums to be added are mixed, or altogether decimals, place them in such manner, as that each figure of every sum may stand directly under those of the same name; then proceed in every respect as in simple addition.

Point off so many places from the total sum, for decimals, as there are decimals in the greatest number added.

EXAMPLES.

1	2	3
84,5675	,85745	538,25
35,6832	,68379	375,025
13,0035	,53048	211,0025
31,6384	,00025	34,75
164,8926	2,07197	1159,0275

4	5
37856,25	35,6843
3572,523	587
485,3748	5438,284
24,15735	63479
41938,30515	69539,9683

6. What is the sum of 85,385—848,25—,3085—28,75—8,4867 and ,835? 967,0152 Answer.

7. What is the sum of 850—3,587—,5873—1,255 and ,79846? 856,22776 Answer.

8. What is the sum of ,8536—7,75—81,113—583—,684 and 3,373? 676,7836 Answer.

9. What is the sum of 4,25—5,075 and 7,0025? 16,3275 Ans.

Subtraction of Decimals.

RULE. Place the numbers as directed in addition of decimals; then subtract as in whole numbers, and from the remainder point off so many places for decimals, as there are decimals in the greatest number.

EXAMPLES.

	1	2	3
From	58,25	368,384	2,857
Take	31,75	59,0038	,98563
Rem.	26,50	309,3802	1,87137

4. From 73,583 take 49, 876. 23,707 Answer.
5. From 3,75 take 1,8975. 1,8525 Answer.
6. From 1,5 take ,3785. 1,1215 Answer.
7. From ,9867 take ,0987. ,8880 Answer.

Multiplication of Decimals.

RULE. Proceed as in Multiplication of whole numbers; then point off so many places of the product for decimals, as there are decimals in both the multiplicand and multiplier; but, if the product does not consist of so many places, the deficiency must be supplied by prefixing cyphers.

EXAMPLES.

	1	2	3
Multiply	3,75	87,25	,5786
by	1,25	,389	3,75
	1875		
	750		
	375		
Product	4,6875	33,94025	2,169750

4
,2536
,0372

5072
17752
7608

,00943392

In this example the number of places in the product being *less* than the number of decimals in the multiplicand and multiplier, the defect is supplied by prefixing two cyphers.

5. Multiply 12,836 by ,354. 4,543944 Ans.
6. Multiply ,3785 by ,003. ,0011355 Ans.
7. Multiply 8,50 by 83,7. 711,450 Ans.
8. What is the product of ,00037 and ,0685? ,000025345 Ans.

Division of Decimals.

RULE. Proceed as in division of whole numbers; then point off so many places of the quotient for decimals, as the dividend has decimal places more than the divisor.

Note 1. If there happen to be not so many places in the quotient as are required, prefix a sufficient number of cyphers to make up the defect.

Note 2. When the decimal places of the divisor are more than those of the dividend, this defect must be supplied by annexing cyphers.*

Note 3. When there is a remainder, cyphers may be annexed to it, which render it capable of being further divided, and the succeeding figures in the quotient are decimals; which, by annexing a cypher, or cyphers, to every succeeding remainder, may be continued at pleasure.

Note 4. When the dividend is a whole number, and the divisor a decimal, annex so many cyphers to the dividend as there are decimal places in the divisor; the quotient figures will be whole numbers till all the annexed cyphers are brought down and divided; then, if there be a remainder, annex a cypher or cyphers to it and divide; the remaining figures in the quotient will be decimals.

N. B. Four or five places of decimals are generally sufficient.

Note 5. When the dividend is a decimal, and the divisor a whole number, divide as in whole numbers till every figure of the dividend is brought down and divided; and if there are not so many places in the quotient as there are decimals in the dividend, supply the defect by prefixing a cypher or cyphers; and if there be a remainder, cyphers may be annexed, and the quotient carried on still further.

Note 6. When the dividend is a decimal, and the divisor a whole number, if the divisor is not contained in the dividend, place a cypher in the quotient in the first place; then, annex a cypher to the dividend, and if the divisor is not contained in the dividend after *one* cypher is annexed, place another cypher in the quotient and annex another to the dividend; thus proceed till the dividend can be divided, and if there be a remainder, a cypher or cyphers may be annexed, and the quotient carried on still further.

EXAMPLES.

1

2,75)23,30625(8,475 quotient.
2200

1306
1100

2062
1925

1375
1375

In this example, there being three places of decimals in the dividend *more* than in the divisor, I point off the three right hand figures of the quotient, viz. 475 for decimals, according to the rule.

* When the dividend consists of an integer only, or when it is a mixed number, if the decimal places of the divisor be more than those of the dividend, supply the defect by annexing cyphers to the integer, or decimal; the quotient figures will be whole numbers, till all the annexed cyphers are brought down and divided; then, if there be a remainder, annex a cypher, or cyphers, and divide; the remaining figures in the quotient will be decimals.

```
    2
12),64896(,05408 quotient.
  60
  ---
  48
  48
  ---
  96
  96
  --
```

In this example, there being not so many places in the quotient as there are decimals in the dividend, the defect is supplied by prefixing one cypher, according to *Note* 1st.

```
    3
,375)4,250(11,333 quot.
  375
  ---
  500
  375
  ---
  1250
  1125
  ----
  1250
  1125
  ----
  1250
  1125
  ----
   125
```

In this example, the dividend is 4,25; and since there are not so many places of decimals in the dividend as there are in the divisor, I annex a cypher according to *Note* 2d. Then, there being a remainder, I annex a cypher to it, and divide according to *Note* 3d, and point off the quotient for decimals; I proceed in the same manner with the two succeeding remainders; and finding every succeeding figure in the quotient, and consequently every succeeding remainder to be the same, having gotten three places of decimals in the quotient, I cease to divide any further. And here I would observe, that whenever there is a continual repetition of the same figure or figures of the quotient, by annexing a cypher or cyphers to every succeeding remainder, if the work were continued *forever*, the figures of the quotient, and likewise every succeeding remainder, would be uniformly the same.

4. Divide 34 by ,345.

```
,345)34000(98,55+* quotient.
  3105
  ----
  2950
  2760
  ----
  1900
  1725
  ----
  1750
  1725
  ----
    25
```

In this example, the dividend being a whole number, I annex as many cyphers to it as there are places in the divisor, according to *Note* 4th; the quotient figures are whole numbers till the cyphers are brought down and divided; then, there being a remainder, I annex a cypher to it, and point off the remaining figures of the quotient for decimals, as in Example 3d.

* This character + signifies that the decimal is not complete, and that, by annexing cyphers to the remainder, it may be further increased.

5. Divide ,985 by 75.

75),985(,01313+ quot.
75
235
225
100
75
250
225
25

In this example, the dividend being a decimal, and the divisor a whole number, I divide till every figure of the dividend is brought down; then, there being not so many places in the quotient as there are decimals in the dividend, the defect is supplied by prefixing a cypher; then, there being a remainder, I annex a cypher to it, and divide, which carries the quotient to a greater degree of exactness. See *Note* 5.

6. Divide ,7 by 75.

75),700(,00933+ quot.
675
250
225
250
225
25

In this example, the dividend being a decimal, and the divisor a whole number, and the divisor not being contained in the dividend, I place a cypher in the quotient in the first place, and then annex a cypher to the dividend, which being still too small, I place another cypher in the quotient, and annex another to the dividend: then proceed as in the other examples. See *Note* 6th.

7.	Divide 7,735 by 3,25.	2,38 Answer.
8.	Divide 18,3578 by ,748.	24,542+ ———
9.	Divide ,68543 by 12,5.	,0548+ ———
10.	Divide 753 by ,578	1302,768+ ———
11.	Divide 1,87 by 3,5	,5342+ ———
12.	Divide ,55736 by 48.	,01161+ ———
13.	Divide 8,38 by ,666	12,582+ ———
14.	Divide 19 by ,333.	57,057+ ———
15.	Divide ,00075 by ,025.	,3 ———

Reduction of Decimals.

CASE I. To reduce a decimal to its lowest terms.

RULE. When there are cyphers at the right hand of a decimal,* cast them off; the decimal will then be in its lowest terms.

	EXAMPLES.		ANSWERS.
Reduce	,756000 ,250000 ,7000 ,5000	to their lowest terms.	,756 ,25 ,7 ,5

* *All decimals except those which have cyphers at the right hand are naturally in their lowest terms.*

CASE II. To reduce decimals of different denominators to those having the same denominator.

RULE. Annex so many cyphers to the *least*, as shall make the number of places equal to the *greatest*; the decimals will then have one common denominator.

EXAMPLES.

Reduce ,8—,75—,25—,378—,9875—,037 to a common denominator.

,8000—,7500—,2500—,3780—,9875—,0370 Answer.

CASE III. To reduce a vulgar fraction to a decimal.

RULE. Annex so many cyphers to the numerator as may be judged necessary;† then divide by the denominator; the quotient will be the decimal required.

Note. If there are not so many places in the quotient as there were cyphers annexed, the deficiency must be supplied by prefixing cyphers.

EXAMPLES.

1. Reduce $\frac{3}{4}$ to a decimal. 4)3,00

,75 Answer.

2. Reduce $\frac{12}{36}$ to a decimal. 36)12,000(,333+ Ans.
108
120
108
120
108
12

3. Reduce $\frac{1}{8}$, $\frac{4}{5}$, $\frac{3}{7}$, $\frac{1}{2}$ and $\frac{8}{9}$ to decimals.

,125. ,8. ,428+ ,5. ,888+ Ans.

4. Reduce $\frac{9}{14}$, $\frac{1}{28}$, $\frac{2}{3}$, $\frac{1}{4}$ and $\frac{33}{81}$ to decimals.

,642+ ,0357+* ,666+ ,25. ,407+ Ans.

5. Reduce $\frac{3}{8}$, $\frac{22}{25}$, $\frac{1}{145}$ and $\frac{3}{43}$ to decimals.

,375. ,88. ,00689+* ,0697+* Ans.

CASE IV. To reduce a low denomination to the decimal of a high denomination.

RULE. Reduce the highest denomination to the lowest mentioned, for a divisor: then annex a competent number of cyphers to that of the low denomination, of which the

† When the denominator consists of one place only, three cyphers are sufficient.

*** *In these examples, there being not so many places in the quotient, as there were cyphers annexed, cyphers are prefixed.*

decimal is required, and divide as in Case 3d; the quotient will be the decimal required.

Note. If there are not so many places in the quotient as there were cyphers annexed, supply the defect by prefixing cyphers.

EXAMPLES.

1. Reduce 1 farthing to the decimal of a pound.

s.
20
12
240
4
960

Then, 960)1,00000(,00104+ Ans.
960
4000
3840
160

2. Reduce 2 and 3 farthings to the decimals of a pound.
,00208+ ,003125 Ans.

3. Reduce 1, 2 and 3 farthings to the decimals of a shilling.
,0208+ ,0416+ ,0625 Ans.

4. Reduce 1, 2 and 3 farthings to the decimals of a penny.
,25 ,5 ,75 Ans.

5. Reduce from 1 to 11 pence to the decimals of pound.

1	2	3	4	5	6	
,00416+	,00833+	,0125	,0166+	,0208+,	,025	} Ans.
7	8	9	10	11		
,02916+	,0333+	,0375	,0416+	,0458+		

6. Reduce from 1 to 11 pence to the decimals of a shilling.

1	2	3	4	5	6	
,083+	,166+	,25	,333+	,416+	,5	} Ans.
7	8	9	10	11		
,583+	,666+	,75	,833+	,916+		

Note. When shillings are to be reduced to the decimal of a pound, if the shillings be an *even* number, half the number, with a comma prefixed, is the decimal; but if the number be *uneven*, annex a cypher to it, and then halve it as before.

EXAMPLES.

7. Reduce from 1 to 19 shillings to the decimals of a pound.

1	2	3	4	5	6	7	8	9	10	shillings.
,05	,1	,15	,2	,25	,3	,35	,4	,45	,5	decimals.
11	12	13	14	15	16	17	18	19		shillings.
,55	,6	,65	,7	,75	,8	,85	,9	,95		decimals.

8. Reduce 3 pwts. to the decimal of a pound Troy.
,0125 Answer.

9. Reduce 4 ounces to the decimal of a lb. Avoirdupois.
,25 Answer.
10. Reduce 7lb. to the decimal of 1 cwt. ,0625 Ans.
11. Reduce 3 inches to the decimal of a yard.
,0833+ Answer.
12. Reduce 8 inches to the decimal of a foot.
,666+ Answer.
13. Reduce 10 inches to the decimal of a mile.
,0001578+ Answer.
14. Reduce 8 yards to the decimal of a mile.
,004545+ Answer.
15. Reduce 15 minutes to the decimal of an hour.
,25 Answer.
16. Reduce 18 hours to the decimal of a day. ,75 Ans.
17. Reduce 65 days to the decimal of a year.
,178+ Answer.

CASE V. To find the true value of any decimal, whether of coin, weight, or measure.

RULE. Multiply the given decimal by so many of the next lower denomination as make *one* in that denomination of which the given decimal is a part; then point off so many places from the right hand of the product as there are places in the given decimal; the left hand figures are whole numbers; then multiply the figures, which were pointed off, by the parts of the next lower denomination, and point off as before; thus proceed through every descending denomination; the figures at the left hand of the several products determine the value of the decimal.

EXAMPLES.

1. What is the value of ,5956 of a pound?

,5956
20 shillings in a pound.
s. 11,9120
12 pence in a shilling.
d. 10,9440
4 farthings in a penny.
q. 3,7760

s. d.
11 10¾ Answer.

2. What is the value of ,384 of a shilling? 4d.½ Ans.
3. What is the value of ,9345 of a pound Troy?
11oz. 4pwt. 6gr. Answer.
4. What is the value of ,75254 of a mile?
240 rod. 4 yds. 1 ft. 4 in. 2 bar. Answer.

5. What is the value of ,857 of a day?
20h. 34m. 4s. Answer.

6. What is the value of ,75 of a year?
273d 18h. Answer.

SINGLE RULE OF THREE DIRECT:

OR,

DIRECT PROPORTION.

In the Single Rule of Three Direct, there are three numbers given, to find a fourth number, which shall be to the third, as the second is to the first; or, in other words, which shall be in proportion to the third, as the second is in proportion to the first.

When *more* requires *more*, or *less* requires *less*, the question is in direct proportion.

When *more* requires *more*, the third term is greater than the first, and then the fourth term, or answer, is greater than the second term. When *less* requires *less*, the third term is less than the first, and then the fourth number, or answer, is less than the second term.

Rule. In stating a question, that number, which is of the same name with the answer required, must be the *second* term.

That number, which asks the question, must be the *third* term.

That number, which is of the same name with the third term, must be the *first* term.

Note 1. The *first* and *third* terms must always be of the same name and denomination.

Note 2. If the second or middle term consist of more than one denomination, it must be reduced to the lowest mentioned.

Having properly stated the question, multiply the second and third terms into each other, and divide the product by the first term; the quotient will be the answer, or number, sought.

Note 3. The answer always comes in the same denomination with the middle term, which, if it be a low denomination, must be reduced to the highest possible.

Note 4. The proportion between the terms, in the Single Rule of Three, is thus expressed, viz. As the first term is to the second, so is the third to the answer required. As 1 : 2 :: 3 : 6.

Examples.

1. If 5 yards of cloth cost 15 dollars, what will 20 yards cost at that rate?

yds. dol. yds.
As 5 : 15 :: 20
20

5)300(60 dol. Ans.
30
0

2. If 20 yards of cloth cost 60 dollars, what will 5 yards of the same cost?

yds. dol. yds.
As 20 : 60 :: 5
5

20)300(15 dol. Answer.
20
100
100

3. If 15 dollars buy 5 yards of cloth; how many yards will 60 dollars buy?

dol. yds. dol.
As 15 : 5 :: 60
60

15)300(20 yds. Ans.
30
0

4. If 60 dollars buy 20 yards of cloth; how many yards will 15 dollars buy?

dol. yds. dol.
As 60 : 20 :: 15
15

100
20

60)300(5 yds. Ans.
300

The four first questions are the same, but differently varied, and are a proof to each other.

Here it may be observed, that, in all the above examples, the first and third terms of each statement are of the same name and denomination, and that the answer is of the same name with the second or middle term, according to the Rule.

5. If 9 yards cost £10 16; what will 63 yards cost at that rate?

yds. £. s. yds.
As 9 : 10 16 :: 63
20

216

In this example, there being two denominations in the middle term, I reduce it to the lowest, which is shillings; then state the question and proceed as in the first examples.

(Carried over.

Then, as 1 yds. : s. :: yds.
9 : 216 :: 63
63

648 *
1296

20 £. s.
9)136 08(1512(75 12 Ans.
9 140
46 112
45 100
10 12
9
18
18

Here the answer comes in a low denomination, viz. shillings, which I reduce to a high denomination, viz. to pounds and shillings, which must always be done in like cases.

6. If 2s. 3d. will buy 3 yards of ribbon; how many yards will 15s. 9d. buy?

s. d. yds. s. d.
As 2 3 : 3 :: 15 9
12 12
27 189

d. yds. d.
Then, as 27 : 3 :: 189
3

27)567(21 yds. Ans.
54
27
27

In this example, there being two denominations in the first and third terms, I reduce them* to the lowest mentioned, viz. to pence; I then state the question, and proceed, as in the other examples.

7. If 8 yards of cloth cost 12 dollars; what will 32 yards of the same cost?

yds. dol. yds. dol.
As 8 : 12 :: 32 : 48 Answer.

8. If 72 yards cost £.71 8; what will 9 yards cost?

yds. £. s. yds. £. s. d.
As 72 : 71 8 :: 9 : 8 18 6 Answer.

9. If £ 60 15 buy 54 yards of cloth; how many yards of the same will £ 10 2 6 buy? 9 yds. Ans.

* *When the first or third terms consist of more than one denomination, they must both be reduced to the lowest mentioned, before the question is stated.*

Note 1. When the first and third terms are federal money, but of different denominations, reduce them to the lowest mentioned, and proceed as in whole numbers.

Note 2. When the middle term is federal money, proceed as in whole numbers, without respect to denomination, till after you have divided; then, if the middle term be dollars and cents,* point off the two right hand figures of the quotient for cents, the left hand figures are dollars; but, if the middle term consist of cents and mills, or dollars, cents and mills, point off the first right hand figure of the quotient for mills, the two next for cents, the remaining figures on the left hand are dollars.

10. If one dollar, 50 cents buy three yards of linen; how many yards will 16 dollars buy?

As cts. 150 : yds. 3 :: cts. 1600

1600

1800
3

150)4800(32 yds. Ans.
450

300
300

11. If eight yards of cloth cost dol. 16, 98, 4; what will 96 yds. of the same cloth cost?

As yds. 8 : dol. cts. m. 16, 98, 4 :: yds. 96.

96

101904
152856

dol. ct. m.
8)1630464(203, 80, 8 Ans.
16

30
24

64
64

64
64

12. If 13 yards of cloth cost 39 dollars; how many yards of the same may be bought for 156 dollars? — 52 yds. Ans.

13. A man bought 36 yards of cloth for 108 dollars, and sold the same at 4 dollars per yard? did he gain, or lose, and how much? Gained 36 dol. Ans.

14. If 7 yards of ribbon cost 6s. 8d.; what will 42 yards cost at that rate? £.2 Ans.

15. A man bought 3 packs of cloth; each pack contained 25 yards. For the first pack he gave 75 dollars; for the second, 50 dollars; and for the third, 37 dollars, 50 cents; he sold the whole at the rate of 2 dollars, 50 cents per yard; did he gain, or lose, and how much? Gained 25 dol. Ans.

* When the middle term is dollars and cents only, if there be a remainder after dividing, annex a cypher to it, and divide; the quotient will be mills.

16. If a man earn 64 dollars in 4 months; how long must he work to earn 304 dollars? 19 months. Ans.

17. If an ounce of silver be worth 1 dollar, 10 cents; what is the value of 5 silver spoons; each weighing 1 oz. 4 pwt.? dol. 6, 60 Ans.

18. If $8\frac{1}{4}$ yards cost 4 dollars, 20 cents; what will $13\frac{1}{2}$ yards cost? dol. 6, 48 Ans.

19. A owes B 798 dollars; but A not being worth so much money, B agrees to take 80 cents on the dollar; what sum must B receive for the whole debt? dol. 638, 40 Ans.

20. A man owes £.693; but is worth only £.462; what must each creditor receive on the pound? 13s. 4d. Ans.

21. If a third of six be three, what will a fourth of twenty be? $7\frac{1}{2}$ Ans.

22. If 95 yards cost 23 dollars, 75 cents; what will 16 yards cost? 4 dol. Ans.

23. If 3lb. of tobacco cost 37 cents, 5 mills; how much of the same may be bought for 3 dollars, 12 cents, 5 mills? 25 lb. Ans.

24. A tub, which holds 130 gallons, is supplied by a pipe which admits 16 gallons into it in 90 minutes; it also has a leak in the bottom, which lets out 10 gallons in the same time. Now if the water begin to come into the tub, when it is empty, in what time will it be filled? 10h. 50m. Ans.

25. Suppose my income be £.135 16 8 per year; how much may I spend per day, in order to lay up £.75 at the year's end? 3s. 4d. per day, Ans.

26. A man bought 72 yards of cloth for 216 dollars, and sold it in such manner as gained 36 dollars; what did he give per yard, and how did he sell it per yard?

3 dollars, gave per yard.
3 dollars, 50 cents, sold it per yd. } Ans.

Note. The above question requires two different statements, as is frequently the case; and sometimes a question requires three or more statements.

27. A man bought 27 yards of cloth for 86 dollars, 40 cents, and sold it in such manner as gained 20 dollars, 25 cents; what did it cost per yard—how did he sell it per yard—and how much did he gain per yard?

dol. 3, 20 cost per yard.
3, 95 sold it per yard. } Answer.
0, 75 gained per yard.

28. If 6s. Massachusetts money be equal to 8s. New-York money; how much York money must be given for £.100 Massachusetts? £.133 6 8 Ans.

29. If a staff, which is 3 feet long, cast a shadow which measures 9 feet; how high is a tree whose shadow, at the *same time*, measures 285 feet? 95 feet. Ans.

30. A ship has a leak, which will fill it, so as to sink in 7 hours; it likewise has a pump, which will clear it in 12 hours. Now, if they begin to pump, when it begins to leak, in what time will it sink?

From	12		h.	h.	h.	h. m.	
Take	7	Then, as	5	: 7 ::	12	: 16 48	Answer.
Rem.	5						

31. If $\frac{4}{5}$ of a ship cost 12580 dollars; what is her whole value?

		dol.		dol.		
As	4	: 12580 ::	5	:	15725	Answer.

32. If a ship cost 13595 dollars; what is $\frac{3}{7}$ of her value?

		dol.		dol.	cts.	m.	
As	7	: 13595 ::	3	:	5826,	42, $8\frac{4}{7}$,	Answer.

33. A man bought $\frac{3}{16}$ of an acre of land, for which he gave 84 dollars; what was the acre valued at? 448 dol. Ans.

34. A man bought a barrel of rum, containing 28 gallons, for 6 shillings per gallon; but, by a leak in the cask, he lost 7 gallons. How must he sell what was saved per gallon, so as not to lose? 8s. Ans.

35. A man bought 1600lb. of tobacco; but after it was cut and dried, it weighed only 1400lb; what did it lose per pound? 2 ounces. Answer.

36. A gentleman bought 85 hogsheads of rum in the West-Indies, for 30 dollars per hogshead. The cost of transportation was 20 cents per hogshead. His own time he valued at 40 dollars, and his other expenses were 60 dollars. Now, I demand how he must sell his rum per hogshead, in order to clear 850 dollars? dol 41, 37, 6 Answer.

37. If I buy a barrel of cider, containing 32 gallons, for £.1 4, and sell it at 4 pence per quart; do I gain or lose, and how much? I gain 18s. 8d. Answer.

38 Suppose a tax of 879 dollars, 45 cents, be laid on a town, and the value of all the estates in the town amount to 175890 dollars: what must a man pay, whose estate is valued at 896 dollars? dol. 4, 48 Ans.

SINGLE RULE OF THREE INVERSE;

OR,

INDIRECT PROPORTION.

In the Single Rule of Three Inverse, there are three numbers given, to find a fourth, which shall be in proportion to the second, as the first is to the third.

When *more* requires *less*, or *less* requires *more*, the question belongs to the Single Rule of Three Inverse.

When *more* requires *less*, the third term is greater than the first; and then the fourth number, or answer required, must be *less* than the second, or middle term. When *less* requires *more*, the third term is less than the first; and then the fourth number, or answer required, must be *greater* than the second, or middle term.

RULE. Having reduced the first and third terms to one denomination, and the second, or middle term, to the lowest denomination mentioned, state the question as in the Single Rule of Three Direct; then, multiply the first and second terms together, and divide the product by the third term; the quotient will be the answer.

EXAMPLES.

1. If 6 men do a piece of work in 18 days; in what time will 12 men do it?

m. d. m.
As 6 : 18 :: 12
6

12)108(9 days. Ans.
108

2 If 12 men do a piece of work in 9 days; how long will it take 6 men to do the same work?

m. d. m.
As 12 : 9 :: 6
12

6)108(18 days. Ans.
6

48
48

3. Suppose I would line 8 yards of broadcloth, which is 1½ yard wide, with shalloon that is ¾ of a yard wide; how many yards of shalloon will be sufficient?

1½ yard is 6 quarters; then, qrs. yds. qrs. yds.
As 6 : 8 :: 3 : 16 Ans.

4. How much cloth that is ¾ yard wide will it take to line another piece of cloth, which is 9½ yards long, and 1¼ yard wide? 23¾ yards, Ans

5. How long will it take 5 men to do the same work which 37 men can do in 15 days 111 days. Answer.

6. If a man perform a journey in 18 days, by travelling 15 hours per day; how long will it take him to perform the same journey, by travelling only 12 hours per day? 22½ days. Ans.

7. A cistern is supplied by a pipe which will fill it in 3 hours. How many pipes of the same bigness will fill it in 30 minutes? 6 pipes. Ans.

8. Suppose I lend a friend 480 dollars for 3 months, he *promising the like* kindness; but when requested, can let

me have only 96 dollars; how long may I keep it to balance the favour? 15 months Ans.

9. How many squares of glass, 6 by 8, will make a square foot?

in. sq. in. sq.
As 144 : 1 :: 48 : 3 Ans.

Note. The answer to any question, in the Single Rule of Three, whether *direct* or *inverse*, may be found by the following rule.

RULE. Make that number, which is of the same name as the answer required, the middle term Call the *first* and *third* terms the *extremes*. Then, consider whether the answer must be *greater* or *less* than the middle term. If the answer must be *greater* than the middle term, multiply the middle term by the greatest extreme, and divide the product by the least; but, if the answer must be *less* than the middle term, multiply the middle term by the least extreme, and divide the product by the greatest; in either case the quotient will be the answer.

10. How many men must be employed to do the same work in 15 days, which 5 men can do in 111 days? 37 men, Ans.

11. If a piece of land be 40 rods long; how wide must it be in order to contain 5 acres?

rod. A. rod. rod.
As 160 : 5 :: 40 : 20 Ans.

12. How much in length, that is 10 rods wide, will make an acre?

rod. A. rod. rod.
As 160 : 1 :: 10 : 16 Answer.

DOUBLE RULE OF THREE;

OR,

COMPOUND PROPORTION.

IN the Double Rule of Three there are five numbers given to find a sixth, which, (if the proportion be direct) shall be in proportion to the fourth and fifth, as the third is to the first and second; but if the proportion be inverse, the sixth number or answer required, will be in proportion to the fourth and fifth, as the first is to the second and third.

RULE. State the question by making that number, which is the *cause* of gain, loss, or action, the first term. That number, which denotes *time* or *distance*, must be the second term. That number, which *is* the gain, loss, or action, must be the third term. The other two numbers in the question must be placed directly under those of the same name. Then, if the blank fall under the third term, multiply the third, fourth and fifth terms into each other for a dividend, and the first and second for a divisor; the quotient will be the answer.

But, if the blank fall under the first or second term, multiply the first, second, and fifth terms into each other for a dividend, and the third and fourth for a divisor; the quotient will be the answer.

Note 1. When the blank falls under the *third* term, the proportion is *direct*; but, when it falls under the *first* or *second* term, the proportion is *inverse*.

Note 2. Before a question can be properly stated, each term in the statement must be reduced to the lowest denomination mentioned.

EXAMPLES.

1. If 100 dollars gain 6 dollars in one year: what will 900 dols. gain in 8 months?

dol. mo. dol.
100 : 12 :: 6
900 : 8
6

100 48
12 900

1200) 43200(36 dol. Ans.
3600

7200
7200

In this example, the blank falls under the third term;* therefore the proportion is direct. I multiply the three last terms together for a dividend, and the two first for a divisor; the quotient is the answer.

2. If 100 dollars gain 6 dollars in one year; in what time will 900 dollars gain 36 dollars?

dol. mo. dol.
100 : 12 :: 6
900 : :: 36
6 12

5400 432
100

5400)43200(8 mo. Ans.
43200

In this example, the blank, falling under the second term, the proportion is inverse; therefore I multiply the first, second, and fifth terms together for a dividend, and the third and fourth for a divisor; the quotient is the answer.

3. If 100 dollars gain 6 dollars in one year; what principal will gain 36 dollars in 8 months?

dol. mo. dol.
100 : 12 :: 6
8 :: 36—900 dol. Answer.

4. If 900 dollars gain 36 dollars in 8 months, what is the rate per cent? or, in other words, what will 100 dollars gain in one year?

dol. mo. dol.
900 : 8 :: 36
100 : 12 6 dol. Answer.

* *The answer always* comes in the same name, with that term under which the blank falls

5. If 900 dollars g ain 86 dollars in eight months; in what time will 100 dollars gain 6 dollars?

dol.	mo.	dol.
900 :	8 ::	36
100 :	::	6—12 months. Answer.

6. If it cost 60 dollars to cart one ton 150 miles; how much will it cost to cart 5 tons 25 miles?

T	M.	dol.
1 :	150 ::	60
5 :	25	50 dol. Ans.

7. A gentleman lent a certain sum of money for three months, to receive interest at 6 per cent; at the end of the time he received 12 dollars for the use of his money; what was the sum lent? 800 dol Ans.

8. If it cost 50 dollars to cart 5 tons 25 miles; how far must one ton be carted, in order to have the cost amount to 60 dollars 150 miles. Answer.

9. A gentleman lent 1200 dollars for a certain time, to receive interest at 6 per cent; at the expiration of the time he received 30 dollars interest; what time was his money lent? 5 months. Ans.

10. What principal, at 6 per cent will gain 1 dol. in an hour, allowing 365 days make a complete year? 146000 dol Ans.

11. If 800 dollars gain 12 dollars in three months; in what time will 50 cents gain one dollar? 33 yrs. 4mo. Ans.

12. If it cost £.3 12 to pasture 2 cows 3 months; what will it cost to pasture 8 cows 5 months? £.24 Answer.

FELLOWSHIP.

Fellowship is a Rule by which several persons trading in company may discover their particular shares of the gain or loss in proportion to their several stocks.

Single Fellowship

Is, when the stock of each partner is continued in trade a certain equal time.

Rule. Add all the particular stocks into one sum; then, as the sum of all the stocks is to the whole gain or loss, so is each man's particular stock to his share of the gain or loss.

Proof. Add all the shares of the gain or loss into one sum; if it be equal to the whole gain or loss, the work is right.

Examples.

1. A, B, and C trade in company. A put into the stock 400 dollars, B put in 300 dollars, and C put in 200 dollars; they gained 270 dollars; what is each man's share of the gain, in proportion to what he put in?

dol. 400 A's stock.
300 B's stock.
200 C's stock.

As 900 : 270 :: 400
400

900)108000(120 dol. A's gain.
900

1800
1800

0

As 900 : 270 :: 300
300

900)81000(90 dol. B's gain.
8100

0

As 900 : 270 :: 200
200

900)54000(60 dol. C's gain.
5400

0

dol. 120 A's gain.
90 B's gain.
60 C's gain.

270 Proof.

2. A, B, C, and D trade together, A put in 800 dollars, B put in 500 dollars, C put in 300 dollars, and D 150 dollars; but by misfortune they lost 350 dollars; what must each sustain of the loss?

dol. 160 A's loss.
100 B's —
60 C's —
30 D's —
} Answer.

3. A gentleman dying, left two sons and a daughter, to whom he bequeathed the following sums, viz. To the first son he gave 1200 dollars, to the second 1000 dollars, and to the daughter, 800 dollars; but it was found that his whole estate amounted only to 750 dollars; what must each child receive of the estate, in proportion to the legacies?

dol. 300 first son's portion.
250 second son's portion.
200 daughter's portion.
} Answer.

4. A, B, and C trade in partnership. A put in 385 dollars, 50 cents; B put in 297 dollars, 75 cents; and C put in 175 dollars, 25 cents; they gained 343 dollars, 40 cents; what is each one's share of the gain?

dol. 154, 20 A's gain.
119, 10 B's —
70, 10 C's —
} Ans.

5. A and B trade together; A put in 540 dollars, B put in a sum unknown; they gained 387 dollars, of which B took 225 dollars for his share: what is A's gain, and what did B put in?

387
225

162 A's gain.

Then, as 162 : 540 :: 225 : 750 dol. B's stock.

6. A, B, and C trade in company. A's stock is £.75 18; B's stock is £.58 10; C's stock is £.40; they gained £.58 2 8. What is each one's share of the gain?

£.25 6 0 A's gain.
19 10 0 B's —
13 6 8 C's —
} Answer.

7. A, B, and C bought a ship, for which they gave 8000 dollars. A paid 2800 dollars, B paid 1980 dollars; and C the rest; by a voyage at sea, they cleared 6400 dollars: what is each man's share of the gain, in proportion to what each paid for the ship?

dol. 2280 A's gain.
1584 B's —
2536 C's —
} Answer.

8. A, B, and C trade together. A put in 300 dollars, B put in 250 dollars, and C put in 120 yards of broadcloth; they gained 412 dollars, of which C's share was 192 dollars: what is A's and B's gain, and what was C's cloth valued at?

dol. 120 A's gain.
100 B's gain.
480 value of C's cloth.
} Answer.

9. A, B, and C trade in company. A put in 520 dollars, B put in 450 dollars, and C 360 dollars: they gained at the rate of 25 per cent.; what is each one's share of the gain?

dol. cts.
As 100 : 25 :: { 520 : 130, 00 A's gain.
450 : 112, 50 B's —
360 : 90, 00 C's —
} Answer.

Double Fellowship.

Double Fellowship is, when the stocks of several persons, trading in company, are continued in trade unequal times.

Rule. Multiply each man's stock by the time it was in trade and add all the products into one sum; then, as the sum of all the products is to the whole gain or loss, so is each man's product to his share of the gain or loss.

Examples.

1. A, B, and C trade in company. A put in 400 dollars for 9 months; B put in 300 dollars, for 6 months; C put in 200 dollars for 5 months; they gained 320 dollars; what is each man's share of the gain?

400 300 200
9 6 5

3600 A's pr. 1800 1000
1800 B's pr.
1000 C's pr.

As 6400 : 320 :: 3600
3600

192000
960

dol.
6400)1152000(180 A's gain.
6400

51200
51200

0

dol. 180 A's gain.
90 B's gain.
50 C's gain.

320 Proof.

As 6400 : 320 :: 1800
1800

256000
320

dols.
6400)576000(90 B's gain.
57600

0

As 6400 : 320 :: 1000
1000

dol.
6400)320000(50 C's gain.
32000

0

2. A, B, and C trade in partnership. A put in 500 dollars for 18 months; B put in 380 dollars for 13 months; C put in 270 dollars for 9 months; they lost 818 dollars, 50 cents; what is each man's loss?

dol. 450,00 A's loss
247,00 B's —
121,50 C's —
} Answer.

3. On the first of January, A began trade with 380 dollars, and on the first of May following he took in B with 270 dollars; on the first of August following, he took in C with 400 dollars; at the end of the year, they found there were gained 496 dollars; what is each man's share of the gain?

dol. 228 A's gain.
108 B's —
100 C's —
} Answer.

4. A and B enter into partnership for one year. A, at first, put in 500 dollars, and at the end of 5 months he put in 150 dollars more. B, at first, put in 600 dollars, and at the end of 9 months he took out 200 dollars; at the year's end, there were gained 682 dollars, 50 cents; what is each man's share of the gain?

dol. 352, 50 A's gain.
330, 00 B's —
} Answer.

5. A and B trade in company. A, on the first of January, put in 420 dollars; but B could not put in any till the first of April; what must he then put in to have an equal share with A, at the year's end?

mo. dol. mo. dol.
As 12 : 420 :: 9 : 560 Answer.

SIMPLE INTEREST.

INTEREST is a sum allowed by the *borrower to the lender*, according to a certain rate per cent which, by law, is established at 6 per cent. that is, 6 pounds or dollars, for the use of 100 pounds or dollars, for one year.

Principal is the sum lent.

Rate is the sum allowed for the use of 100 dollars or pounds for one year.

When the interest and principal are added together, the sum is called the *amount*.

CASE I. To find the interest of any sum for one year, when the principal is in lawful money.*

RULE. Multiply the principal by the rate per cent. ; then, cut off the two right hand figures of the highest denomination ; reduce the two right hand figures which were cut off from the highest denomination, to the next lower denomination, and cut off as before ; thus proceed to reduce and cut off, till you have brought it to the lowest denomination. The figures at the left hand of each denomination determine the interest of the sum for one year.

Note. To find the interest for any number of years, multiply the interest of one year by the number of years ; the product will be the answer.

EXAMPLES.

1. What is the intereft of £.486 10 8, for 1 year, at 6 per cent ?

£.	s.	d.
486	10	8
		6
29	19	4 0
	20	
3	84	
	12	
10	08	
	4	
£.	s.	d.
32	29	3 10 Ans.

2. What is the interest of £.58 13 4, for 1 year, at 5 per cent ?

£.	s.	d.
58	13	4
		5
2	93	6 8
	20	
18	66	
	12	
8	00	
£.	s.	d.
2	18	8 Ans.

* Although the rules for finding the interest of any sum, for any given time, when the principal is in lawful money, will apply to federal money, yet particular rules will be given hereafter

3. What is the interest of £.120 6 8½ for 5 years, at 6 per cent?

£	s.	d.	
120	6	8½	
		6	
7|22	0	3	
	20		
4|40			
	12		
4|83			7 4 4¾ Interest for 1 year.
	4		5
3|32			£.36 1 11¼ Interest for 5 years.

QUESTIONS. ANSWERS.

Principal. £.	s.	d.	time.	rate.	Interest. £.	s.	d.
4 675	8	6	for 1 year, at	6 per cent.	40	10	6.
5 300	13	4	for 3	6	54	2	4½.
6 42	17	3	for 4	5	8	11	5.
7 16	8	4	for 1	4½	0	14	9¼.
8 1	0	0	for 1	6	0	1	2¼.

CASE II. To find the interest of any sum, for any number of months, when the rate is 6 per cent.

RULE. Multiply the principal by half the number of months, and cut off, as in Case 1st.

EXAMPLES.

1. What is the interest of £.48 10 6 for 8 months, at 6 per cent.?

£.	s.	d.	
48	10	6	
		4	
1|94	2	0	
	20		
18|32			
	12		
9|84			
	4		
£.	s.	d.	
3|36	1	18	9¾ Ans.

2. What is the interest of £.36 18 4 for 7 months, at 6 per cent.?

£.	s.	d.	
36	18	4	
		3½	
110	15	0	
18	9	2	
1|29	4	2	
	20		
5|84			
	12		
£.	s.	d.	
10|10	1	5	10 Ans.

3. What is the interest of £.24 15 4½ for 10 months, at 6 per cent? £.1 4 9¼ Ans.

4. What is the interest of £.13 3 4 for 6 months, at 6 per cent? £.0 7 10¾ Ans.

5. What is the interest of £.10 8 6 for 15 months, at 6 per cent? £.0 15 7½ Ans.

6. What is the interest of £.5 16 3 for 18 months, at 6 per cent? £.0 10 5½ Ans.

7. What is the interest of £.3 14 7 for 11 months, at 6 per cent.? £.0 4 1¼ Ans.

8. What is the interest of £.9 6 8 for 20 months, at 6 per cent? £.0 18 8 Answer.

CASE III. Interest for months, when the rate is *more* or *less* than 6 per cent.; likewise, interest for weeks and days, at any rate per cent. may be found by the Double Rule of Three.

EXAMPLES.

1. What is the interest of £.24 for 8 months, at 5 per cent?

£. mo. £.
100 : 12 :: 5
24 : 8

5
40
24
100 160
12 80
1200 960
20

1200) 19200(16s. Ans.
1200
7200
7200

2. What is the interest of £.18 for 5 weeks, at 6 per cent?

£. w. £.
100 : 52 :: 6
18 : 5

6
30
18
240
52 30
100 540
20

s. d.
5200) 10800(2 0¼ Answer.
10400
400
12
5200)4800(0
4
5200)19200(3
15600
3600

3. What is the interest of £.400 for 73 days, at 6 per cent?

£. days. £.
100 : 365 :: 6
400 : 73

6
438
365 400
100
36500) 175200(£. s.
146000 4 16 Answer.
29200
20
36500) 584000(16
36500
219000
219000

To find the interest of any sum, the principal being in federal money.

CASE I. When the principal is dollars only, to find the interest for one year.

RULE. Multiply the principal by the rate per cent.; then, cut off the two right hand figures of the product for cents: the left hand figures are dollars.

EXAMPLES.

1. What is the interest of 345 dollars for 1 year, at 6 per cent?

dols.
345
6
dol. 20,70 Ans.

2. What is the interest of 125 dollars for 1 year, at 5 per cent?

dols.
125
5
dol. 6,25

3. What is the interest of 480 dollars for 1 year, at 6 per cent? dol. 28, 80 Answer.

4. What is the interest of 320 dollars for 4 years, at 6 per cent? dol. 76, 80 Answer.

5. What is the interest of 17 dols. for 1 year, at 6 per cent? dol. 1, 02 Ans.

6. What is the interest of 139 dollars for 2 years, at 6 per cent? dol. 16, 68 Answer.

7. What is the interest of 48 dollars for 8 years, at 8 per cent? dol. 4, 32 Answer.

CASE II. To find the interest for one year, when the principal is dollars and cents, or cents only.

RULE. Multiply the principal by the rate per cent; then cut off the first right hand figure of the product, which is to be considered as *nothing*; then point off the first right hand figure for mills, the two next for cents; the figures remaining on the left hand are dollars.

EXAMPLES.

1. What is the interest of 85 dollars, 75 cents for 1 year, at 6 per cent?

dol. ct.
85, 75
6
dol. 5,14,5|0 Answer.

2. What is the interest of 24 dollars, 50 cents for 1 year, at 6 per cent?

dol. ct.
24, 50
6
dol. 1,47,0|0 Ans.

3. What is the interest of 48 dollars, 25 cents for 1 year, at 6 per cent? dols. 2, 89, 5 Ans.

4. What is the interest of 25 dollars, 66 cents for 4 years,* at 6 per cent? dol. 6, 15, 8 Answer.

5. What is the interest of 387 dollars, 84 cents for 3 years, at 6 per cent.? dol. 69, 81, 1 Answer.

CASE III. To find the interest for 1 year, when the principal is cents and mills, or dollars, cents and mills.

* *To find the interest for any number of years, multiply by the rate per cent; that product by the number of years; then cut off as the rule directs.....NOTE.* This rule applies to Case III.

RULE. Multiply the principal by the rate per cent; then cut off the two right hand figures of the product, which are to be considered as *nothing*; this being done, point off the first right hand figure for mills, the two next for cents; the figures remaining on the left hand are dollars.

EXAMPLES

1. What is the interest of 146 dollars, 75 cents, 6 mills for 1 year, at 6 per cent?

dol. ct. m.
146, 75 6
6

dol. 8, 80, 5|36 Answer.

2. What is the interest of 87 dollars, 33 cents, 7 mills for 1 year, at 8 per cent?

dol. ct. m.
87, 33, 7
8

dol. 6, 98, 6|96 Ans.

3. What is the interest of 95 dollars, 50 cents, 3 mills, for 1 year, at 6 per cent? dol. 5, 73, 0 Answer.

4. What is the interest of 24 dollars, 84 cents, 9 mills, for 3 years, at 6 per cent? dols. 4, 47, 2 Answer.

5. What is the interest of 48 dollars, 25 cents, 5 mills, for 5 years, at 5 per cent? dol. 12, 06, 3 Ans.

6. What is the interest of 359 dollars, 12 cents, 3 mills, for 1 year, at 6 per cent? dol. 21, 54, 7 Answer.

7. What is the interest of 75 cents, 5 mills, for 4 years, at 6 per cent? cents 18, 1 Answer.

CASE IV. To find the interest for any number of months, when the principal is dollars only, and the rate 6 per cent.

RULE. Divide the principal by 2, and multiply the quotient by the given number of months; then point off the two right hand figures of the product for cents; the left hand figures are dollars.

EXAMPLES.

1. What is the interest of 398 dollars for 9 months, at 6 per cent?

dol.
2)398
199
9

dol. 17, 91 Answer.

2. What is the interest of 453 dollars for 5 months, at 6 per cent?

dol.
2)453
226$\frac{1}{2}$
5

dol. 11, 32$\frac{1}{2}$ Answer.

3. What is the interest of 48 dollars for 7 months, at 6 per cent? dol. 1, 68 Answer.

4. What is the interest of 750 dollars for 15 months, at 6 per cent? dol. 56, 25 Answer.

5. What is the interest of 185 dollars for 11 months, at 6 per cent? dol. 10, 17$\frac{1}{2}$ Answer.

6. What is the interest of 124 dollars for 3 months, at 6 per cent.? dol. 1, 86 Answer.

7. What is the interest of 97 dollars for 4 months, at 6 per cent? dol. 1, 94 Answer.

CASE V. To find the interest for any number of months, when the principal is dollars and cents, or cents only, and the rate 6 per cent.

RULE. Divide the principal by 2, and multiply the quotient by the given number of months; then cut off the first right hand figure of the product, with the fraction, if there be any, which is to be considered as *nothing*; this being done, point off the first right hand figure for mills, the two next for cents; the remaining figures on the left hand are dollars.

EXAMPLES.

1. What is the interest of 24 dollars, 50 cents, for 6 months, at 6 per cent?

dol. ct.
2)24, 50
12, 25
6
cents 73, 5|0 Answer.

2. What is the interest of 84 dollars, 25 cents for 7 months, at 6 per cent?

dol. ct.
2)84, 25
42, 12½
7
dol. 2,94,8|7½ Answer.

3. What is the interest of 175 dollars, 66 cents, for 9 months, at 6 per cent? dol. 7, 90, 4 Answer.

4. What is the interest of 8 dollars, 75 cents, for 18 months, at 6 per cent? cents 78, 7 Answer.

5. What is the interest of 19 dollars, 20 cents for 8 months, at 6 per cent? cents 28, 8 Answer.

6. What is the interest of 36 dollars, 84 cents for 5 months, at 6 per cent? cents 92, 1 Answer.

CASE VI. To find the interest for any number of months, when the principal is dollars, cents, and mills, or cents and mills only, and the rate 6 per cent.

RULE. Divide the principal by 2, and multiply the quotient by the given number of months; then cut off the two right hand figures of the product, which are to be considered as *nothing*; this being done, point off the first right hand figure for mills, the two next for cents; the remaining figures on the left hand are dollars.

EXAMPLES.

1. What is the interest of 125 dollars, 68 cents, 4 mills, for 5 months, at 6 per cent?

dol. ct. m.
2)125, 68, 4
62, 84, 2
5
dol. 3, 14, 2|10 Answer.

2. What is the interest of 75 dollars, 50 cents, 7 mills, for 9 months, at 6 per cent?

dol. ct. m.
2)75, 50, 7
37, 75, 3½
9
dol. 3,39, 7|81½ Answer.

3. What is the interest of 356 dollars, 33 cents, 6 mills for 4 months, at 6 per cent ? dol. 7, 1[illegible], 6 Answer.

4. What is the interest of 66 cents, 4 mills, for 19 months, at 6 per cent ? cents 6, 3 Answer.

5. What is the interest of 48 dollars, 84 cents, 9 mills, for 8 months, at 6 per cent ? dol. 1, 95, 3 Answer.

6. What is the interest of 4 dollars, 08 cents, 6 mills, for 16 months, at 6 per cent ? cents 32, 6 Answer.

7. What is the interest of 158 dollars, 09 cents, 5 mills, for 7 months, at 6 per cent ? dol. 5, 53, 3 Answer.

CASE VII. To find the interest of any sum, for any number of days, when the rate is 6 per cent.

RULE. Multiply the principal by the number of days, and divide the product by 6083 ; the quotient (when pointed off as directed in division of federal money) will be the interest required.

EXAMPLES.

1. What is the interest of 400 dollars for 73 days, at 6 per cent ?

days.
73
400
dol. ct.
6083)29200(4, 80 Answer.
24332
486800
48664
160

2. What is the interest of 125 dollars, 75 cents, 6 mills, for 40 days, at 6 per cent ?

dol. ct. m.
125,75,6
40
ct. m.
6083)503 02 40(82, 6 Ans.
486 64
16 38 4
12 16 6
4 21 80
3 64 98
56 82

3. What is the interest of 346 dollars, 50 cents for 60 days, at 6 per cent ? dol. 3, 41, 7 Answer.

4. What is the interest of 890 dollars for 5 days, at 6 per cent ? cents 73, 1 Answer.

5. What is the interest of 48 dollars, 25 cents, 7 mills for 23 days, at 6 per cent ? cents 18, 2 Answer.

6. What is the interest of 25 dollars for 280 days, at 6 per cent ? dol. 1, 15 Answer.

Compound Interest.

Compound Interest is, when the interest is added to the principal every year successively.

Rule. Find the interest of the first year (by Simple Interest) and add it to the principal; the amount is the principal for the second year; thus proceed for every succeeding year; then, having found the amount for the given number of years, subtract the first principal therefrom, the remainder is the Compound Interest.

Examples.

1. What is the compound interest of 680 dollars for 4 years, at 6 per cent?

	dol.	
	680	principal for the 1st year.
	6	
	40,80	interest of ditto.
	680	principal for the first year.
	40,80	interest of ditto.
	720,80	principal for the 2d year.
	6	
	43,24,8|0	interest of ditto.
	720,80	principal for the 2d year.
	43,24,8	interest of ditto.
	764,04,8	principal for the 3d year.
	6	
	45,84,2|88	interest of ditto.
	764,04,8	principal for the 3d year.
	45,84,2	interest of ditto.
	809,89,0	principal for the 4th year.
	6	
	48,59,3|40	interest of ditto.
	809,89,0	principal for the 4th year.
	48,59,3	interest of ditto.
	858,48,3	amount for 4 years.
subtract	680,00,0	principal for the 1st year.
remaind.	178,48,3	compound interest.

2. What is the compound interest of 1000 dollars for 5 years, at 6 per cent? dol. 338, 22, 4 Answer.

3. What is the compound interest of 480 dollars for 4 years, at 6 per cent? dol. 125, 98, 8 Answer.

4. What is the compound interest of 400 pounds for 5 years, at 4 per cent? £.86 13 2 Answer.

LOSS AND GAIN.

LOSS and GAIN is a rule, by which merchants discover their profit or loss per cent. It likewise teaches them to fix the price of their goods, in order to gain or lose a certain rate per cent.

CASE I. When goods are bought at one price, and sold at another, to find the gain or loss per cent.

RULE. Find the gain or loss per yard, pound, &c. by subtraction; then (by direct proportion) as the price it cost is to the gain or loss per yard, pound, &c. so is 100 pounds or dollars to the gain or loss per cent.

EXAMPLES.

1. If cloth be bought for 6 shillings per yard, and sold at 7 shillings and 6 pence, what is gained per cent?

	s.	d.
Sold for	7	6
cost	6	0
gain	1	6 per yard.

6*s.* are 72 pence.
1*s.* 6*d.* are 18 pence.

Then, as 72 : 18 :: 100

	d.	d.	£.
	72	18	100
			100

72)1800(25*l.* Ans.
144
360
360

Note. The first and second terms must be of the same name and denomination.

2. If cloth be bought for 7 shillings and 6 pence per yard, and sold at 6 shillings per yard, what is lost per cent.?

	s.	d.
cost	7	6
sold	6	0
loss	1	6 per yard.

Then, as 90 : 18 :: 100

	d.	d.	£.
	90	18	100
			100

90)1800(20*l.* Ans.
180
0

3. If I buy cloth for 2 dollars per yard, and sell it for 2 dollars, 50 cents per yard, what do I gain per cent, or by laying out 100 dollars?

	dol.	ct.
sold	2,	50
cost	2,	00
gained	0,	50 per yard.

As 200 : 50 :: 100

	ct.	ct.	dol.
	200	50	100
			100

200)5000(25 dol. Ans.
400
1000
1000

4. If I buy cloth for 4 dollars per yard, and sell it for 5 dollars per yard, what do I gain per cent? dol. 25 Ans.

5. If I buy ribbon at 8 pence per yard, and sell it at 1 shilling per yard, what do I gain per cent? £.50 Answer.

6. If I buy cloth for 2 dollars, 50 cents per pard, and sell it for 2 dollars per yard, what do I lose per cent?
dol. 25 Answer.

7. At 15 cents profit in the dollar, how much per cent?
dol. 15 Answer.

8. At 4 mills profit in the cent, how much per cent?
dol. 40 Answer.

9. At two pence profit in the shilling, how much per cent?
£.16 13 4 Answer

10. At 3 shillings profit in the pound, how much per cent?
£.15 Answer.

11. Suppose I buy 47 yards of cloth for 141 dollars, and sell it for 3 dollars, 75 cents per yard, do I gain or lose, and how much per cent?

47)141(3 dol. cost per yard.
141

	dol.	ct.
sold	3,	75
cost	3,	00
gained	0,	75 per yard.

dol. ct. dol. dol.
As 3 : 75 :: 100 : 25 Answer.

CASE II. To fix the price upon goods, in order to gain or lose a certain rate per cent.

RULE. As 100 pounds,* or dollars, is to the price it cost, so is 100 pounds or dollars, with the gain per cent. added, or loss per cent subtracted, to the price for which the article must be sold, in order to gain or lose the proposed rate per cent.

EXAMPLES.

1. If I buy cloth for 6 shillings per yard, how must I sell it per yard, so as to gain £.25 per cent?

£. s. £.
As 100 : 6 :: 125
6
100)750(7s. 6d. Ans.
700
50
12
100)600(6
600

2. If I buy flour for 8 dollars per barrel, how must I sell it per barrel, in order to gain 50 dollars per cent?

dol. dol. dol.
As 100 : 8 :: 150
8
100)1200(12 dol. Ans.
1200

* In this Case the first and third terms must be of the same name and denomination.

3. If I buy cloth for 7s. 6d. per yd. how must I sell it per yd. so as to lose 20 per cent?

£. d. £.
As 100 : 90 :: 80
80

100)7200(72d. are 6s. Ans.
700
200
200

4. If I buy cloth for 3 dollars per yard, how must I sell it per yard to lose 10 dollars per cent?

dol. dol. dol.
As 100 : 3 :: 90
90

dol. 2,70 Answer.

5. Suppose I buy 1 cwt. of cotton for 28 dollars, how must I sell it per pound, to gain 50 dollars per cent?

112)28,00(25 cts. cost per pound.

dol. cts. dol. cts. m.
Then, as 100 : 25 :: 150 : 37,5 Answer.

6. If I buy ribbon for 1 shilling per yard, how must I sell it per yard to gain £.33 6 8 per cent? 1s. 4d. Answer.

7. If thread cost 1 cent per skein, how must it be sold per skein to gain 50 dollars per cent? cents 01, 5 Answer.

8. Bought a quantity of fish, for 20 shillings per quintal; but, it being damaged, I am willing to lose £.15 per cent; how must I sell it per quintal? 17s. Answer.

9. If cloth cost 2 dollars per yard, how must it be sold per yard to gain 25 dollars per cent? dol. 2,50 Answer.

10. If I buy land for 3 dollars per acre, how must I sell it per acre to gain 75 dollars per cent? dol 5, 25 Answer.

PARTICULAR RULES.

Having the length and breadth of a piece of land given in rods, to find how many acres it contains.

Rule. Multiply the length and breadth together, and divide the product by 160; the quotient will be acres, and the remainder, (if there be any) will be rods.

Examples.

1. How many acres in a piece of land 40 rods long, and 30 wide?

40
30

A. rods.
160)1200(7 80 Answer: Or, 7½ acres.
1120
80

2. How many acres in a piece of land 120 rods long, and 48 wide? 36 acres. Answer.

Having the length and breadth of any surface given in feet, yards, &c. to find how many square feet, yards, &c. it contains.

Rule. Multiply the length and breadth together; the product will be the answer in feet, yards, &c.

EXAMPLES.

1. How many square feet are there in a floor which is 18 feet long, and 14 wide?

18
14
72
18
252 square feet, Answer.

2. How many square feet in a table which is 9 feet long, and 4 wide? 36 Answer.

3. How many square yards are there in a garden which is 45 yards long, and 33 yards wide? 1485 Answer.

Having the length and breadth of any surface given in feet and inches, to find how many square feet it contains.

RULE. In the first place, reduce them to inches; then multiply the length and breadth together, and divide the product by 144, the quotient will be square feet, and the remainder (if there be any) will be inches.

EXAMPLES.

1. How many square feet in a board which is 12 feet, 8 inches long, and 1 foot, 4 inches wide?

ft.	in.	ft.	in.
12	8	1	4
12		12	
152 in. long.		16 in. wide.	

Then, 152
16
912
152
144)2432(16 ft. 128 in. Ans.
144
992
864
128

2. How many square feet in a table 5 feet long, and 3 feet, 6 inches wide?

60 inches long.
42 inches wide.
120
240
144)2520(17 ft. 72 in. Ans.
144
1080
1008
72

Or thus, 5
$3\frac{1}{2}$
$2\frac{1}{2}$
15
$17\frac{1}{2}$ Ans.

Having the length, breadth and thickness of any solid body given, to find its contents.

RULE. Multiply the length, breadth and thickness into each other, the product will be the answer.

EXAMPLES.

1. How many solid or cubic feet are there in a stick of timber, which is 9 feet long, 2 feet wide, $1\frac{1}{2}$ foot thick?

9
2
18
$1\frac{1}{2}$
18
9
27 Answer.

2. How many solid or cubic feet in a body of hay, which is 35 feet high, 23 wide, and 15 thick? 12075 Ans.

To reduce pounds to dollars, cents, &c.

RULE. Annex one cypher to the pounds, and divide by three; the quotient will be dollars; then, if there be a remainder, annex two cyphers to it and divide; the quotient will be cents; and, if there still be a remainder, annex one cypher and divide; the quotient will be mills.

N. B. Separate mills from cents, and cents from dollars, by a comma.

EXAMPLES.

1. Reduce 37 pounds to dollars, cents, &c.

3)370

dol. 123,33,3 Answer.

Or, you may annex four cyphers to the pounds, and divide by 3; then point off the first right hand figure of the quotient for mills, the two next for cents, the left hand figures are dollars.

2. Reduce 45 pounds to dollars, cents, &c.

3)450000

dol. 150.00,0 Answer.

To reduce dollars to pounds, shillings, &c.

RULE. Multiply the dollars by 3, and double the unit figure of the product for shillings; the other figures are pounds.

EXAMPLES.

1. Reduce 356 dollars to pounds.

dol.
356
3

£.106 16 Ans.

2. Reduce 180 dollars to pounds.

dol.
180
3

£.54 0 Answer.

A TABLE,

Reducing the shillings, pence and farthings of New-England, to dollars, cents, and mills.

		ct. m.	d.	ct. m.	s.	dol.ct.m.		dol. ct. m.
farthings.	1	00, 3	6	08, 3	1	0, 16, 7	11	1, 83, 3
	2	00, 7	7	09, 7	2	0, 33, 3	12	2, 00, 0
	3	01, 0	8	11, 1	3	0, 50, 0	13	2, 16, 7
Pence.	1	01, 4	9	12, 5	4	0, 66, 7	14	2, 33, 3
	2	02, 8	10	13, 9	5	0, 83, 3	15	2, 50, 0
	3	04, 2	11	15, 3	6	1, 00, 0	16	2, 66, 7
	4	05, 6	12	16, 7	7	1, 16, 7	17	2, 83, 3
	5	06, 9			8	1, 33, 3	18	3, 00, 0
					9	1, 50, 0	19	3, 16, 7
					10	1, 66, 7	20	3, 33, 3

DUODECIMALS.

DUODECIMALS is a rule, which of all others, if accurately understood, is the most expeditious for finding the contents of boards, timber, or cord wood.

This rule is called *Duodecimals*, because every inferior denomination *decreases*, in a *twelve-fold* proportion.

Dimensions are commonly given in *feet*, *inches*, and parts of an inch.

RULE 1. Place feet under feet ; inches under inches, &c.

RULE 2. Having properly stated the question, begin with the *highest* denomination of the *multiplier*, (that is feet) and multiply it *crosswise* into the *lowest* denomination of the multiplicand, observing, in every denomination, to carry *one* for every *twelve*.

RULE 3. Having multiplied every denomination of the multiplicand, by the *feet*, in the multiplier, begin with the *inches*, in the multiplier, and proceed as in the first instance, observing to set the first figure of the product one place to the right hand of the first product ; thus proceed with every succeeding denomination.

RULE 4. Add the several products together, their sum will be the answer required.

EXAMPLES.

1. Multiply 3 feet, 8 inches, by 2 feet, 2 inches.

3 : 8
2 : 2
7 : 4
0 : 7 : 4
7 : 11 : 4 Ans.

2. Multiply 5 feet, 3 inches, by 3 feet, 4 inches.

5 : 3
3 : 4
15 : 9
1 : 9 : 0
17 : 6 : 0 Ans.

In the first example, I begin with the *feet*, in the multiplier, and multiply them into the *inches* of the multiplicand, thus ; two times 8 are 16, which is one foot, four inches ; I set down 4, and then say, two times 3 are 6, and one I carry are 7, which I set down. I then proceed to multiply the *inches*, in the multiplier, into the inches of the multiplicand, and set the first figure of the product, one place to the right hand of the first figure, in the first product. Lastly, I add the two products together, and find the amount to be 7 feet, 11 inches, and four twelfths of an inch ; or, in other words, 7 feet, 11 twelfths of a foot, and 4 twelfths of an inch.—Note. The inferior denominations below feet are sometimes called *primes*, *seconds*, *thirds*, &c. and are *thus marked* ; primes (′) seconds (″) thirds (‴) &c.

Multiply 4 : 3′ : 2″
By 3 : 4 : 7

12 : 9 : 6
1 : 5 : 0 : 8
2 : 5 : 10 : 2

14 : 5′ : 0″ : 6‴ : 2⁗ Ans.

SUPERFICIAL MEASURE is that which considers *length* and *breadth*, without regard to *thickness*.

PRACTICAL QUESTIONS.

1. How many feet are there in a board 8 feet long, and 1 foot, 4 inches wide?

8 : 0
1 : 4

8 : 0
2 : 8 : 0

10 : 8 : 0 Ans.

2. How many feet in a table 6 feet, 9 inches long, and 3 feet, 5 inches wide?

6 : 9
3 : 5

20 : 3
2 : 9 : 9

23 : 0 : 9 Ans.

3. How many feet in a board 10 feet, 7 inches long, and 9 inches wide? 7 : 11′ : 3″ Answer.

4. How many feet in a floor 10 feet, 8 inches wide, and 11 feet, 9 inches long? 125 : 4′ Answer.

5. How many feet in a board, 9 feet, 6 inches, and a quarter long, and 5 inches and an half wide?

4 : 4′ : 4″ : 4‴ : 6⁗ Answer.

Note. When the length of a board or stick of timber, *exceeds* twelve feet, or any number of *times twelve*, find the contents of twelve feet in length, in the first place; then multiply the contents of twelve feet in length, by as *many* as there are *twelves*, in the length of the board or timber; then, by a separate operation, find the contents of the *overplus*, (if there be any) and add it to the contents of the *even twelve*, or *twelves*; their sum will be the contents of the whole length.

EXAMPLES.

1. How many feet in a board 18 feet, 7 inches long, and 12 inches wide?

12 : 0 Length.
1 : 2 Width.

12 : 0
2 : 0 : 0

14 : 0 : 0 Con. of 12 ft.
7 : 8 : 2 Con. of overplus.

21 : 8 : 2 Con. of 18 ft. 7 in. Ans.

6 : 7 Overplus of 12 feet.
1 : 2 Width.

6 : 7
1 : 1 : 2

7 : 8 : 2 Con. of overplus.

2. How many feet in a board 27 feet, 8 inches long, and 11 inches wide?

12 : 0 Length.	3 : 8 Overplus of 24 ft.
0 : 11 Width.	0 : 11 Width.
11 : 0 : 0 Con. of 12 ft.	3 : 4 : 4 Con. of overplus.
2	
22 : 0 : 0 Con. of 24 ft.	
3 : 4 : 4 Con. of overplus.	
25 : 4 : 4 Con. of 27 ft. 8 in. Ans.	

3. How many feet in a board, 38 feet, 10 inches long, and 13 inches wide? 42 : 0′ : 10″ Answer.

4. How many feet in a board 19 feet, $5\frac{1}{2}$ inches long, and $10\frac{1}{2}$ inches wide? 17 : 0′ : 3″ : 9‴ Answer.

Note. Painting, and some other kinds of work, are done by the square yard; and, in order to find how many square yards any piece of work contains, find how many *feet* there are, by the foregoing rules; then divide the feet by 9, and the quotient will be the number of square yards.

Examples.

1. How many square yards are there in a fence 12 ft. 8 in. long, and 5 ft. 4 in. high?

12 : 8
5 : 4
63 : 4
4 : 2 : 8
9)67 : 6 : 8
$7\frac{4}{9}$ yds. Ans.

2. How many yards in a room 11 ft. 10 in. long, and 10 ft. 9 in. wide?

11 : 10
10 : 9
118 : 4
8 : 10 : 6
9)127 : 2 : 6
$14\frac{1}{9}$ yds. Ans.

3. Agreed to have several pieces of work painted, at 20 cents per square yard. What will the whole amount to, the several pieces being of the following dimensions?

1.	5	: 8′	by	3	: 9′
2.	4	: 9	by	6	: 3
3.	9	: 10	by	2	: 5
4.	[illegible]	: 0	by	0	: 7
5.	20	: 1	by	0	: 3
6.	12	: 2	by	2	: 6

2 dols. 59 cts. Answer.

Cubic, or Solid Measure, is that, which considers *length, breadth, and thickness.*

RULE. Multiply the breadth and thickness together, and their product, by the length; the last product will be the contents in cubic, or solid feet, and parts of a foot.

EXAMPLES.

1. How many cubic, or solid feet are there in a stick of timber 8 inches wide, 6 inches thick, and 9 feet, 3 inches long?

0 : 8′ Width.
0 : 6 Thickness.
0 : 4 : 0 Product.
9 : 3 Length.
3 : 0
1 : 0
3 : 1 : 0 Ans.

2. How many cubic feet in a plank 15 inches wide, 4 inches thick, and 12 feet, 6 inches long?

1 : 3′ Width.
0 : 4 Thickness.
0 : 5 : 0 Product.
12 : 6 Length.
5 : 0
2 : 6
5 : 2 : 6 Ans.

3. How many cubic feet are there in a chest which is 3 feet, 4 inches wide, 2 feet, 9 inches deep, and 6 feet, 3 inches long? 57 : 3′ : 6″ Answer.

4. How many cubic feet are there in a piece of timber, 10 inches wide, 8 inches thick, and 9 feet, 4 inches long? 5 : 2′ : 2″ : 8‴ Answer.

5. How many cubic feet in a piece of timber, which is hewn 18 inches by 15 inches, and 12 feet, 8 inches long? 23 : 9′ Answer.

Note. When a piece of timber exceeds 12 feet, or any number of *times twelve* feet in length, multiply the *width* and *thickness* together, as in the foregoing examples, and then proceed as directed in the note under *Superficial Measure.*

1. How many cubic feet in a stick of timber, 11 inches wide, 9 inches thick, and 44 feet, 6 inches long?

0 : 11′ Width.
0 : 9 Thickness.
0 : 8 : 3 Pro. of 11 by 9.
12
8 : 3 : 0 Con. of 12.
3
24 : 9 : 0 Con. of 36.
5 : 10 : 1 : 6 Con. of 8 ft. 6 in.
30 : 7 : 1 : 6 Con. of 44 ft. 6 in. Ans.

0 : 8′ : 3″ Prod. of 11 by 9.
8 : 6 Overplus of 36.
5 : 6 : 0
4 : 1 : 6
5 : 10 : 1 : 6 Con. of 8 feet 6 in.

2. How many cubic feet in a piece of timber 27 feet long, and hewn 14 inches by 16? 41 ft. Answer.

3. How many feet in a stick of timber, which is hewn 8 inches square, and 19½ feet long? 8 : 8′ Ans.

4. How many ft. in a joist 4 inches by 6, and 50 ft. long?
8 : 4′ Ans.

Cord Wood.

A Cord of wood is a pile, 8 feet long, 4 feet wide, and 4 feet high, and contains 128 cubic feet, or 8 feet of cord wood.

As the superficial contents of *one end* of a cord of wood, are exactly *double* to the number of *cord wood feet*, therefore, in order to find the number of feet of cord wood, in any load, multiply the *height* by the *width*, duodecimally, and divide the product by *two*, the quotient will be the number of cord wood feet, and parts of a foot, which the load contains.

Examples.

1. How many feet of wood in a load 3ft. 6in. high, and 3ft. 6in. wide?

3 : 6
3 : 6
10 : 6
1 : 9 : 0
2)12 : 3 : 0
6½ Ans.

2. How many feet of wood in a load 4ft. 3in. high, and 3ft. 5in. wide?

4 : 3
3 : 5
12 : 9
1 : 9 : 3
2)14 : 6 : 3
7¼ Ans.

In these examples, each load is considered as consisting of *two tiers*, each of which is supposed to be cut four feet long according to law.

Note 1. After having multiplied the height, and width of any load of wood together, the figures which occupy the place of *inches*, in the product, are not *twelfth* parts of a foot, because, as they are to be divided by *two*, they are only *twenty-fourths* of a foot; therefore, 3 is ⅛, 4 is ⅙, 6 is ¼, 8 is ⅓, and 9 is ⅜. When the figures in the place of inches happen to be 5, 7, 10, or 11, as these figures are not *even* parts of 24, I call 5, ⅙; 7, ¼; 10, ⅝; 11, ⅜; or ½, as the case may be; that is, if the figure in the *third* place be *less* than 6, I call 11, ⅜; but, if it be *more* than 6, then I call 11, ½.

Note 2. The figures in the *third* place are so inconsiderable, that they are not reckoned into the contents of a load.

3. How many feet of cord wood, in a load, 3ft. 9 in. high, and 2 ft. 10 in. wide?

3 : 9
2 : 10
7 : 6
3 : 1 : 6
2)10 : 7 : 6
5¼ Ans.

4. How many feet of cord wood, in a load, 4 ft. 7 in. high, and 3 ft. 8 in. wide?

4 : 7
3 : 8
13 : 9
3 : 0 : 8
2)16 : 9 : 8
8⅜ Ans.

In the above examples, the 7, which occupies the place of inches in the *one*, I call $\frac{1}{4}$ of a foot, although it is, in reality, *one twenty-fourth* part of a foot *more* than a quarter. The 9, which occupies the place of inches, in the other example, is exactly $\frac{3}{8}$ of a foot.

The 6, which possesses the *third* place, in one example, and the 8, in the other, are not reckoned into the quantity.

5. How many feet of cord wood, in a load, 4 ft. 4 in. high, and 3 ft. 1 in. wide?

```
  4 : 4
  3 : 1
 ------
 13 : 0
  0 : 4 : 4
 ---------
2)13 : 4 : 4
 ---------
 6⅔ Ans.
```

In this example 13 divided by 2 are $6\frac{1}{2}$, and 4, which occupies the place of inches, is $\frac{1}{6}$ of a foot; therefore $\frac{1}{2}$, which is $\frac{3}{6}$, being added to $\frac{1}{6}$, produces $\frac{4}{6}$, which is exactly $\frac{2}{3}$.

6. How many feet of cord wood are there in a load, which is three ft. 11 inches high, and 3 ft. 10 in. wide?

$7\frac{1}{2}$ Ans.

Note. When wood is cut *less*, or *more*, than 4 ft. long, find the contents of the load, by the foregoing examples; then *deduct* or *add*, as the case may require, so many *forty-eighths* of a foot, as the number of feet in the load will produce when multiplied by the number of inches it falls short, or overruns.

7. How many feet of cord wood are there in a load 4 ft. high, and 3 ft. wide, and cut only 3 ft. 9 in. long?

```
  4 : 0
  3 : 0
 -------
2)12 : 0
 -------
    6
   ⅜ deduct.
 -------
 5⅝ Ans.
```

In this example, the contents of the load, in case it were cut 4 ft. long, is 6 ft. But as it lacks 3 inches of 4 ft. multiply 3 by 6, and the product is 18, which is *eighteen forty-eighths*; and $\frac{18}{48}$ is $\frac{3}{8}$, which being deducted from 6, leaves $5\frac{5}{8}$, the real quantity of the load.

8. How many feet of cord wood in a load, 4 ft. 3 in. high, and 3 ft. 6 in. wide, and cut 4 ft. 7 in. long?

$8\frac{3}{8}$ Answer.

9. How many feet of cord wood in a load, 3 ft. 7 in. high, and 3 ft. 8 in. wide, and cut 3 ft. 6 in. long? $5\frac{1}{4}$ Ans.

10. How many feet of cord wood in a load, 4 ft. 2 in. high, and 3 ft. 8 in. wide?

$7\frac{1}{8}$ Answer.

Solomon Thornton, of Randolph, Dr.

1798.		dols. cts.
Feb. 3.	To 8 bushels wheat, at 1,66 cts	13, 28
9.	To 29lb. beef, at 6½ cts.	1, 88½
17.	To 3 bushels rye, at 1,50 cts.	4, 50
20.	To 5 bushels potatoes, at 25 cts.	1, 25
25.	To 10 pair of shoes, at 1,75 cts.	17, 50
March 8.	To 75lb. cheese, at 10 cts.	7, 50
12.	To 3 thousand of clear boards, at 13 dols. a thousand.	39, 00
18.	To 7 cords oak wood, at 3 dols.	21, 00
25.	To 4 days' work done by myself and 1 yoke of oxen, at 1,40 cts.	5, 60
May 7.	To 28 yds. tow-cloth, at 22 cts.	6, 16
15.	To 19lb. butter, at 20 cts.	3, 80
June 5.	To 2 days' work at hoeing, done by myself, at 83 cts a day.	1, 66
29.	To 7lb. pork, 18½ cts.	1, 29½
Sept. 25.	To 9 barrels of cider, at 1,33 cts.	11, 97
		136, 40
	Settled October 15, 1798.	

FORMS OF NOTES.

$100. BOSTON, July 4, 1808.

For value received, I promise to pay Peregrine Pickle, *or order, one hundred dollars, on demand, with interest.*

WITNESS, Jonathan Trusty.
Thomas Tinker.
Robinson Crusoe.

$95,06 BOSTON, July 4, 1808.

For value received of Peter Industry, *I promise to pay him, or order, in ninety days from date, ninety five dollars, six cents, with interest after.*

Attest, Harry Recompense.
Dick Remember.
John Steady.

to Walter Underwood, Cr.

1798.		dols. cts.
March 8.	By 4 bush. salt. at 75 cts.	3, 00
12.	By 1¾ cwt. flour, at 6 dols. per cwt	10, 50
19.	By 3 gal W. I rum, at 1,50 cts.	4, 50
28	By 18 yds of linen, at 40 cents.	7, 20
April 2.	By 10lb. sugar at 15 cts.	1, 50
9.	By 2 pieces nankeen, at 1,25 cts.	2, 50
15.	By a side of soal-leather, weighing 28lb. at 20 cents.	5, 60
23.	By 12 yds. broadcloth at 4,50 cts.	54, 00
29.	By 3 qts. Sherry wine, at 35 cts.	1, 05
May 5.	By 4 doz. waistcoat buttons, at 67 cts. a doz.	2, 68
23.	By ½ cwt. of rice, at 3,34 cts.	1, 67
July 5.	By a brass kettle, weighing 25lb. at 50 cts. per lb.	12, 50
Oct. 15.	By cash to balance.	29, 70
		136, 40

October 15, 1798. Settled all book accounts heretofore contracted between us.

Walter Underwood.
Solomon Thornton.

ORDER.

Boston, July 4, 1808.

Mr. Richard Bountiful,

Sir, *Please to pay* Ned Needy, *nine dollars, forty-six cents, and place the same to my account.*

$.9,46. Constant Charitable.

RECEIPTS.

Boston, July 4, 1808.

Received of William Pitt *twenty dollars on account.*

$.20 Charles Fox.

$.100. Boston, July 4, 1803.

Received of Christopher Columbus, *one hundred dollars, in full of all demands.* Americus Vespucius.

A TABLE,

In which the gold coins of Great-Britain and Portugal are reduced to an equivalent value in dollars and cents.

gr.	ct.	gr.	ct.	pwt.	dol.	ct.	pwt.	dol.	ct.
1	3	13	48	1	0,	89	11	9,	78
2	7	14	51	2	1,	78	12	10,	67
3	11	15	55	3	2,	67	13	11,	55
4	14	16	59	4	3,	55	14	12,	44
5	18	17	63	5	4,	44	15	13,	33
6	22	18	67	6	5,	33	16	14,	22
7	25	19	70	7	6,	22	17	15,	11
8	29	20	74	8	7,	11	18	16,	00
9	33	21	78	9	8,	00	19	16,	89
10	37	22	81	10	8,	89	20	17,	78
11	40	23	85						
12	44								

A TABLE,

In which the gold coins of France and Spain are reduced to an equivalent value in dollars and cents.

gr.	ct.	gr.	ct.	pwt.	dol.	ct.	pwt	dol.	ct.
1	3	13	47	1	0,	87	11	9,	63
2	7	14	51	2	1,	75	12	10,	51
3	11	15	55	3	2,	63	13	11,	39
4	14	16	58	4	3,	50	14	12,	26
5	18	17	62	5	4,	38	15	13,	14
6	22	18	66	6	5,	25	16	14,	01
7	25	19	69	7	6,	13	17	14,	89
8	29	20	73	8	7,	01	18	15,	76
9	33	21	76	9	7,	88	19	16,	64
10	36	22	80	10	8,	76	20	17,	52
11	40	23	84						
12	44